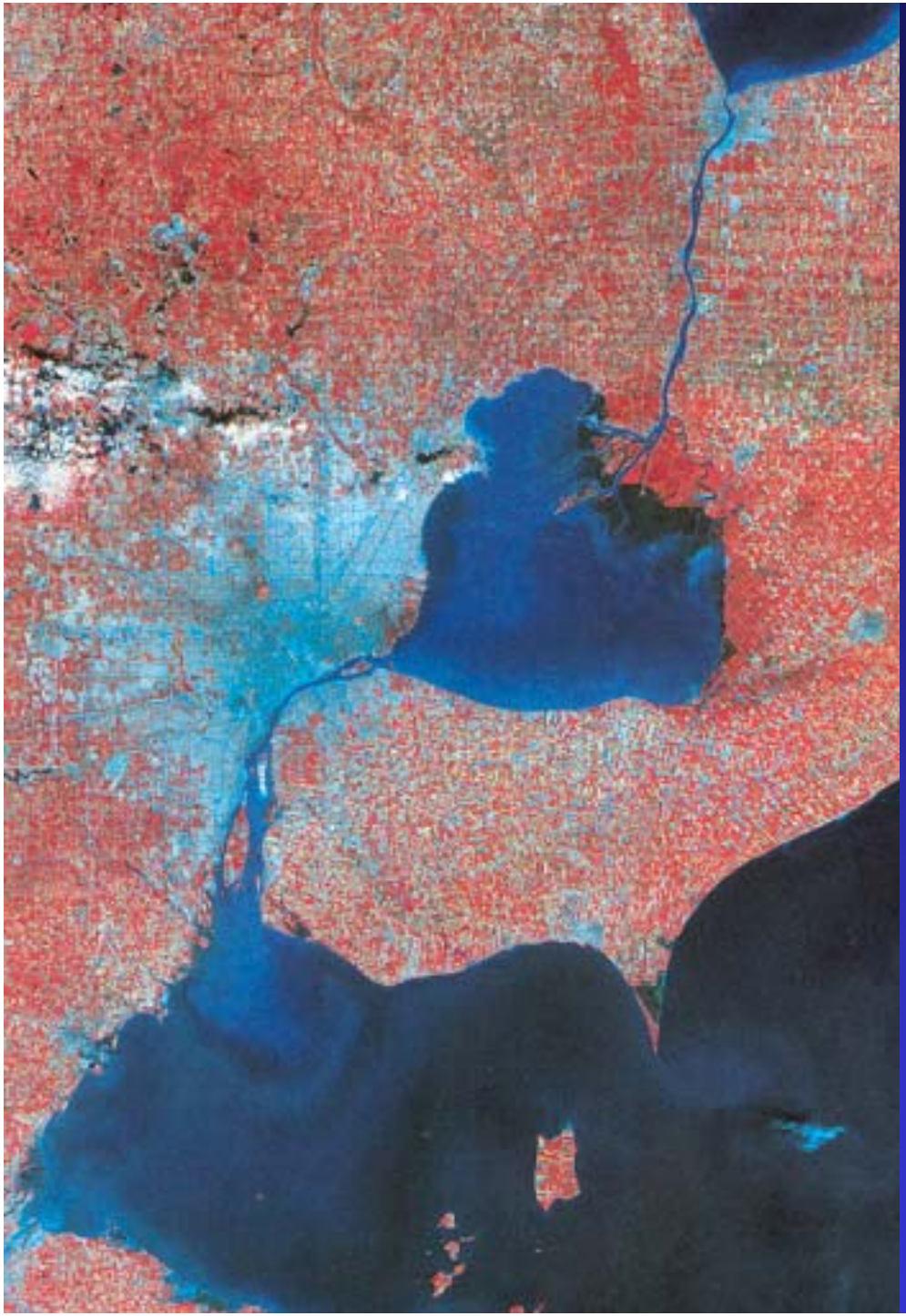
The Lake St. Clair and Saginaw Bay Fish Community

- Robert Haas and Michael Thomas
- Michigan Department of Natural Resources
- Mt. Clemens Fisheries Research Station
- Mt. Clemens, MI

- Jeff Schaeffer
- USGS Great Lakes Science Center
- Ann Arbor, MI

USGS science for a changing world

Michigan DNR
Michigan Dept. of Natural Resources



Lake St. Clair Facts

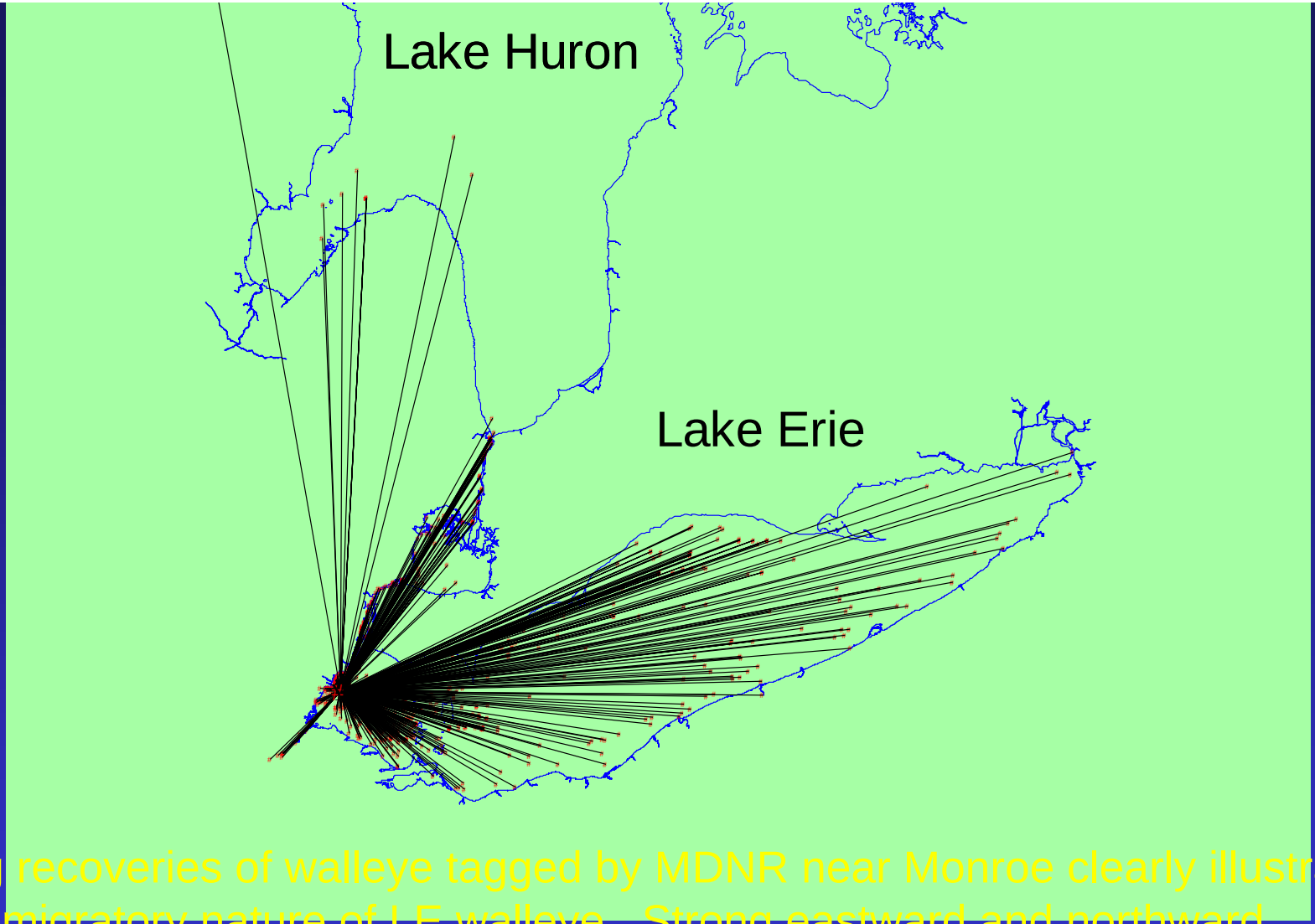
- Flow through system about 200,000 ft^3/sec – equal to Mississippi River
- Surface area of 1,114 km^2
- Average depth of 3m
- Maximum natural depth of only 6.4m
- Hydraulic retention time from 2 to 30 days
- Human population within the metropolitan Detroit area of 4.8 million
- Unique freshwater delta system

The Lake St. Clair Fish Community is Healthy

- A Diverse and intact community
  - High diversity
  - Most original species present
- Sport Fishing
  - Unique Fisheries
  - Social and economic benefits
- Endangered species
  - Safe Haven for fishes that are rare elsewhere
- Issues that affect the fish community

Walleye

- Most popular fish on St. Clair, Detroit Rivers
- Some local declines within the Lake, but overall population is healthy
- Lower catch rates in the lake may be a consequence of habitat change

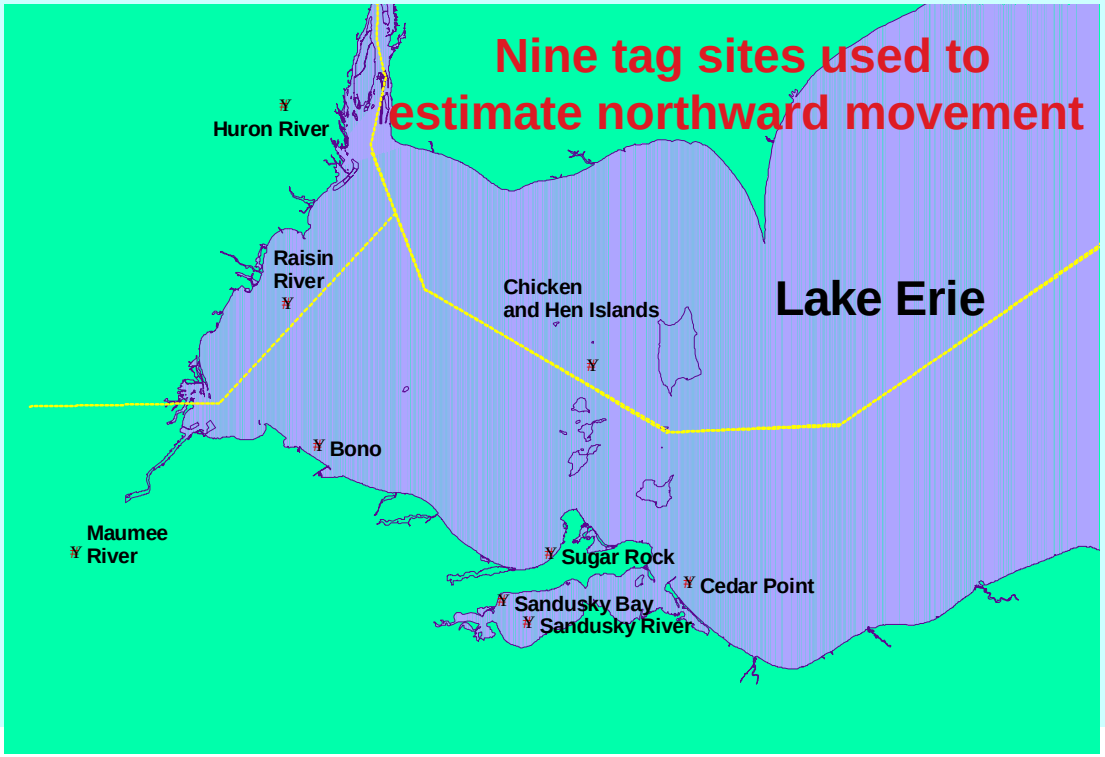


Tag recoveries of walleye tagged by MDNR near Monroe clearly illustrate the migratory nature of LE walleye. Strong eastward and northward movement patterns are obvious. Seasonal patterns of tag recoveries indicate that many walleye that spawn in the Western Basin spend much of the remainder of each year in the Central Basin, Eastern Basin, St. Clair System, or even Lake Huron.

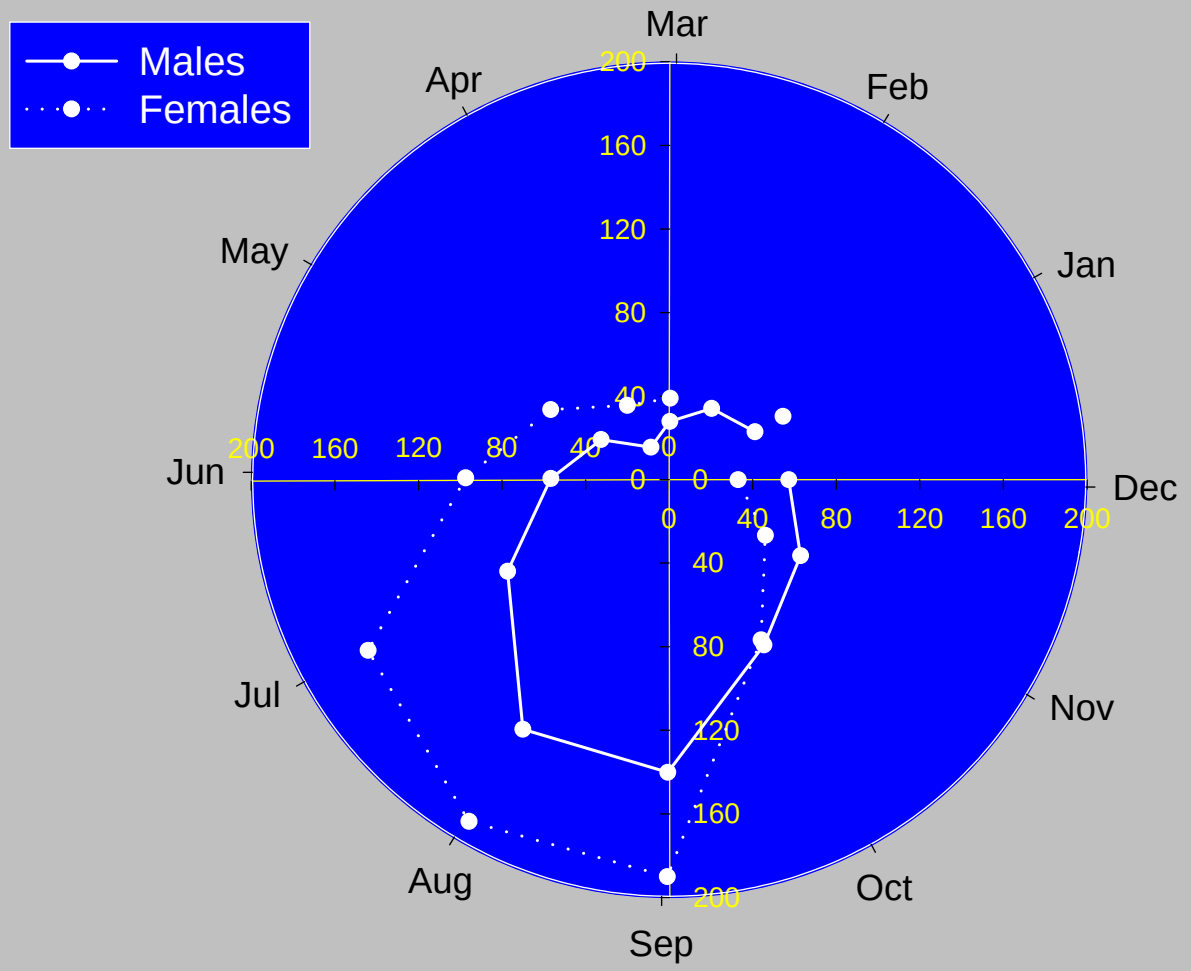
Estimated Lake Erie walleye abundance and number moving into Detroit River and North (Estimates of number moving north based on tag recoveries in those waters)

Year	Adult walleye abundance
1978	14,072,811
1979	25,758,111
1980	32,927,711
1981	31,705,281
1982	28,776,858
1983	24,483,998
1984	59,273,654
1985	42,335,159
1986	44,507,268
1987	43,508,105
1988	76,050,820
1989	62,091,758
1990	44,980,060
1991	31,692,050
1992	32,567,790
1993	40,959,870
1994	28,377,580
1995	29,051,958
1996	31,539,620
1997	18,908,601
1998	25,920,439
1999	22,843,640
2000	19,162,236
2001	33,354,029
2002	23,215,660

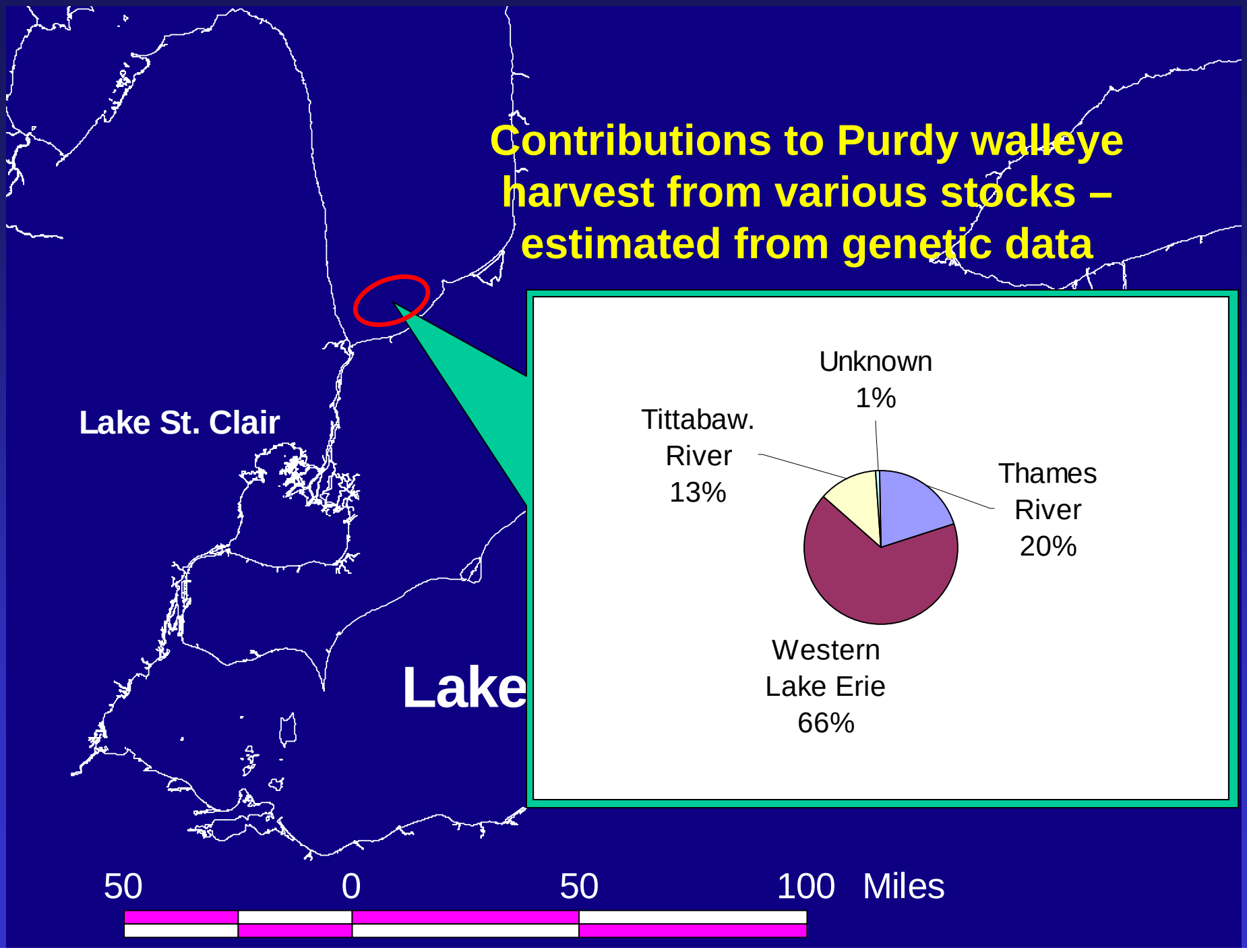
Estimation of walleye moving into Detroit River and North	
Tag Recoveries	
Walleye tag recoveries from Lk. Erie =	3,280
Recovered in Lk. Erie (85%) =	2,785
Recovered north of Lk. Erie (15%) =	495
Average Lake Erie walleye population =	34,722,603
Annual number moving North =	5,208,390



Lake Erie Tagged Walleye
Mean Distance (km) from Tag Site



Contributions to Purdy walleye harvest from various stocks – estimated from genetic data



Diversity is High

- 74 fish species captured during MDNR surveys
- 21 of 22 Species found during 1898 are still present
- New species still being found

Smallmouth Bass

Nationally recognized sport fishery for smallmouth bass

National stature is illustrated by professional bass tournaments held on Lake St. Clair over the past 3 years

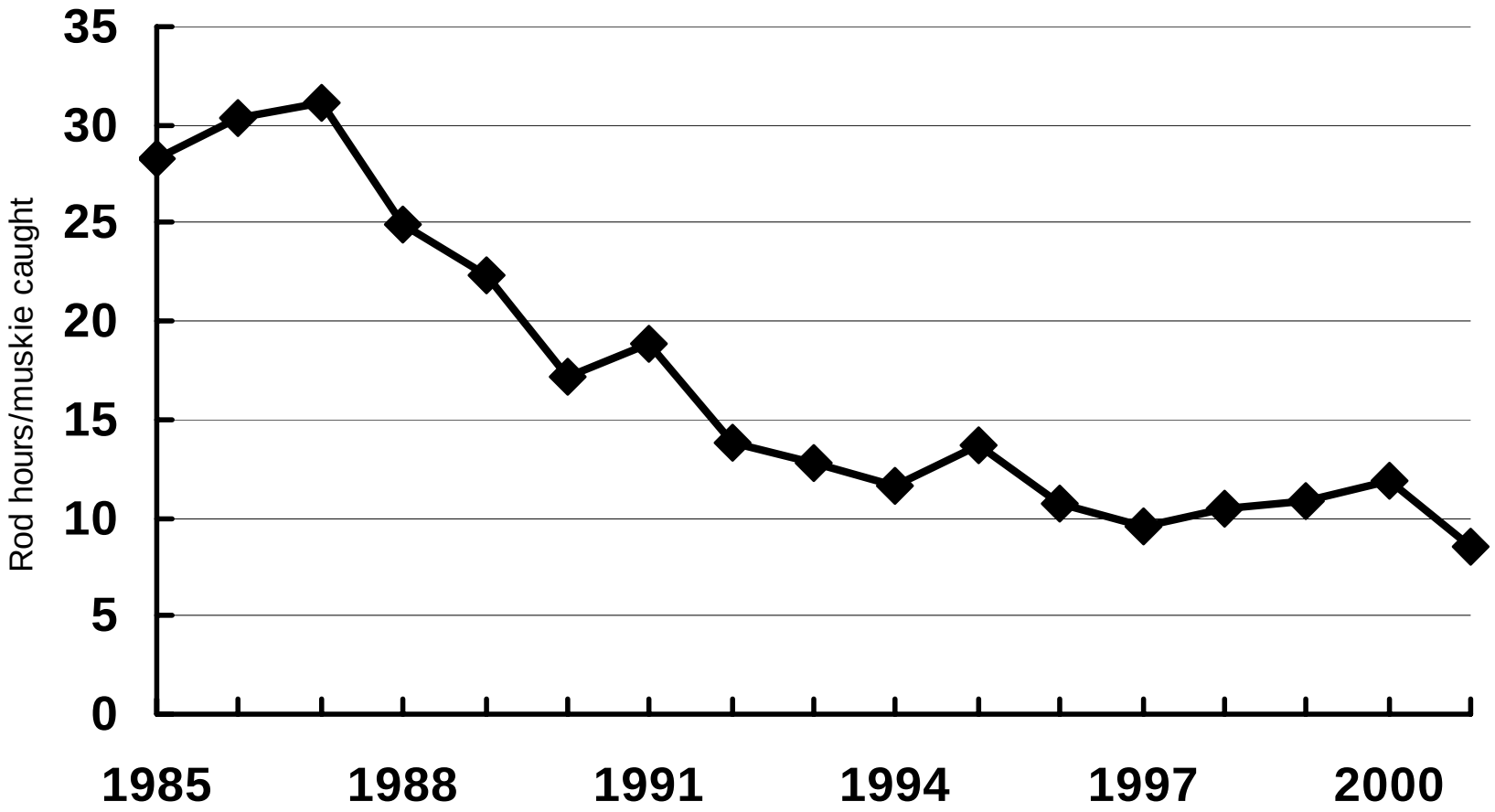
Population and angler effort both increasing

Muskellunge

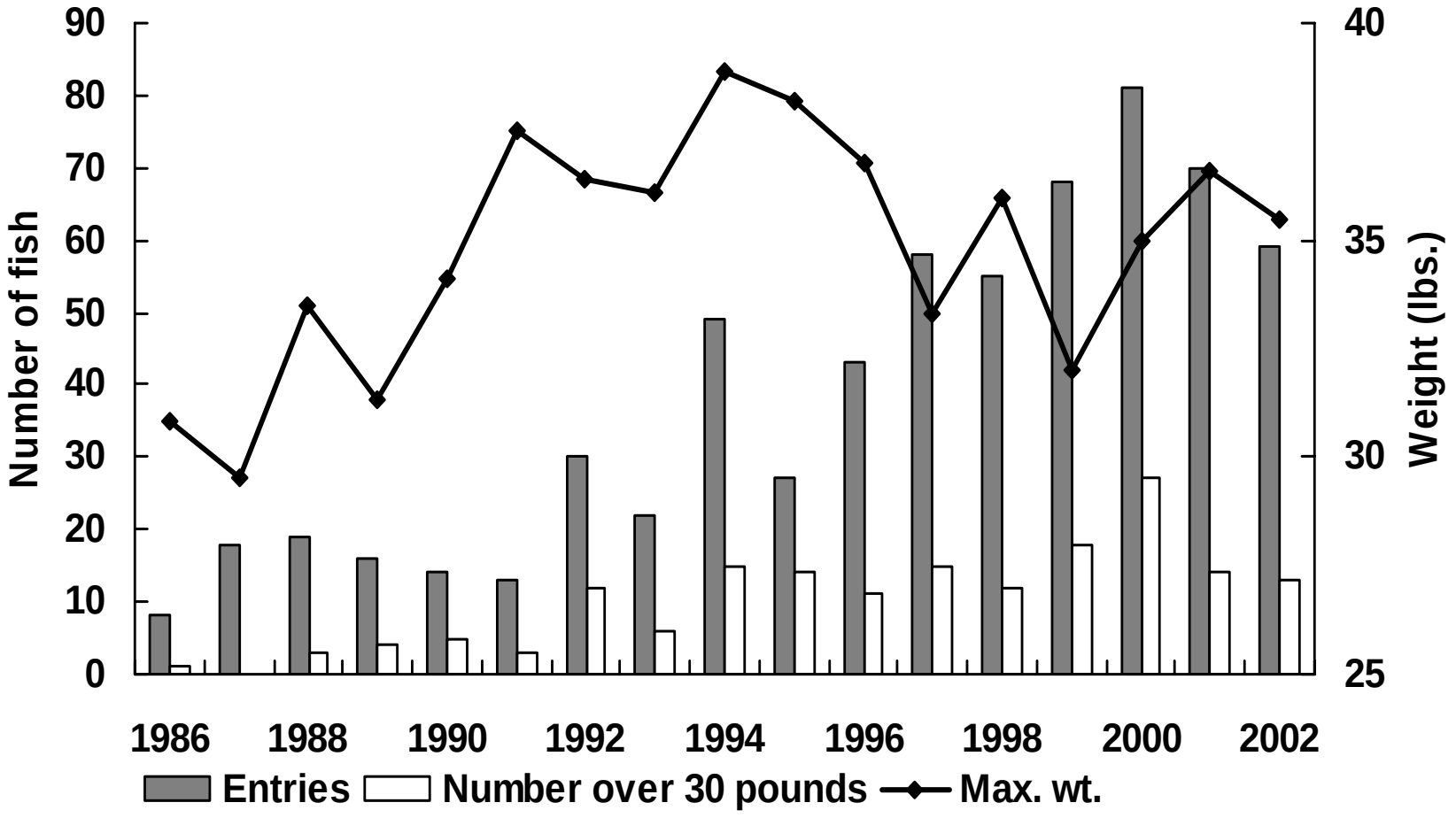
- **Large Population, high catch rates (10x other fisheries)**
- **Supports a thriving charter industry**
- **Catch and Release**
- **Population size and angler effort both increasing**

Photo from Miller's Motor City Muskie Charters Website

Recent trends in Lake St. Clair Muskie Abundance



Angler diary program catch rates (expressed as rod hours per fish caught) for muskellunge from Lake St. Clair



Master Angler program entries for Lake St. Clair muskellunge

Lake St. Clair Muskellunge and Piscirickettsia: a newly identified pathogen

Mike Thomas, Fisheries Research Biologist
Mt. Clemens Fisheries Research Station

- Factors contributing to the consistent high quality of this fishery include:
  - a positive response to increased minimum size limits on both sides of the lake since the mid-1980's;
  - physical and biological changes in the lake such as clearer water and increased aquatic plant growth resulting in improved habitat for muskellunge; and,
  - increased voluntary catch and release fishing for muskies in Lake St. Clair by both sport and charter anglers.

- MDNR workers began to notice red sores/spots on LSC muskie in 2000.
- No complaints from anglers about muskies with sores.
- Unusual incident of dead large muskies observed by anglers in Detroit River and Lake St. Clair in spring 2003.

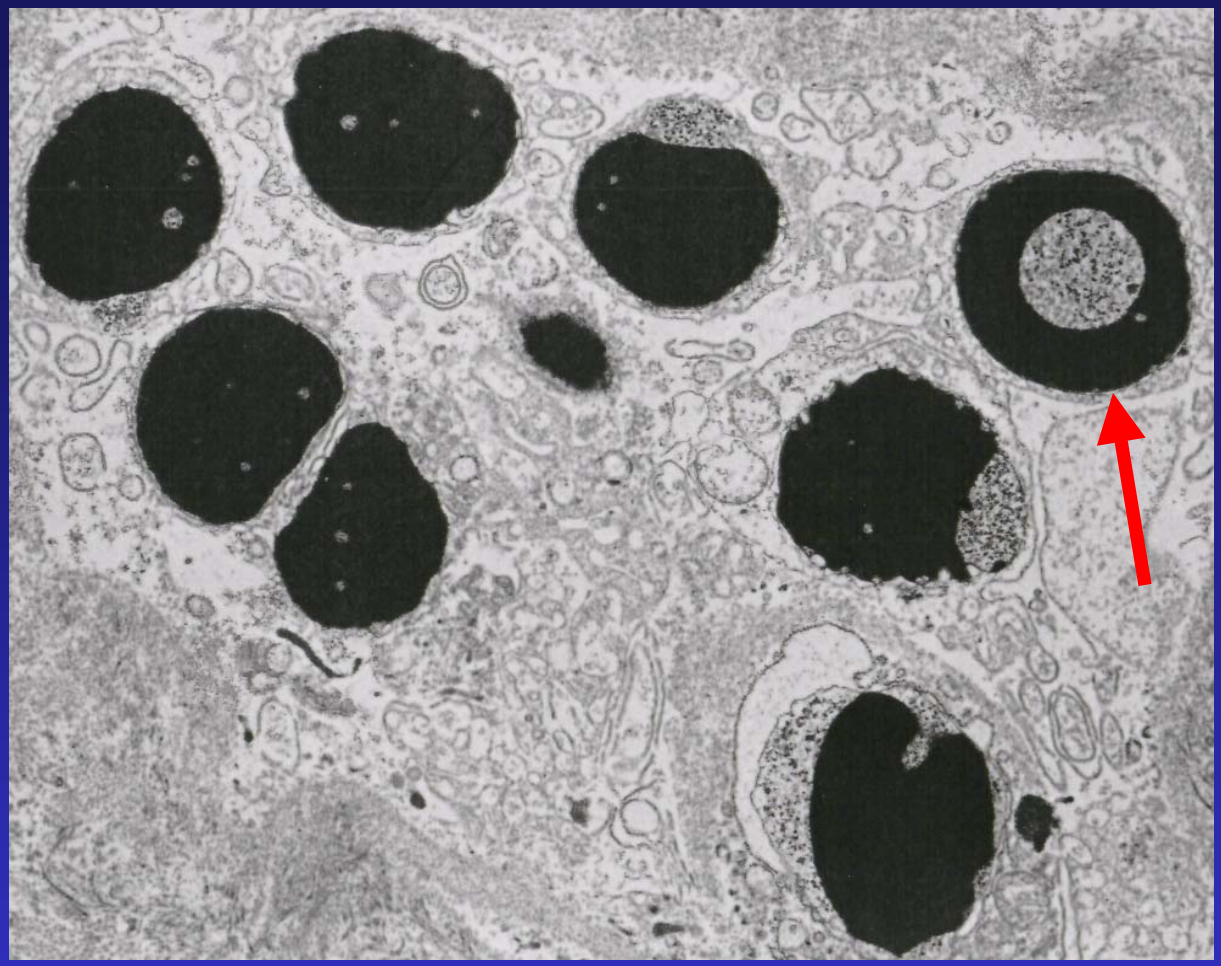
Dead muskies in Spring 2003

- **Beginning in mid-April, unusual reports of large, dead muskies began coming from anglers in the Detroit River**
- **Reports have continued through the present time**
- **Mortality factor(s) isn't known**
- **Coincidence that disease identified in 2002 and muskie mortality occurs in spring 2003?**

- Lesions were in the form of raised, reddish, scabby looking sores, often circular in shape, that varied in diameter from 3 mm to 2 cm.

In May, 2002, muskies with red sores were collected with trap nets from Anchor Bay and examined/sampled by Dr. M. Faisal.

Dr. Faisal collected samples from the external lesions and from internal organs.



Electron microscopy and live-cell culture verified the presence of a Piscirickettsia-like bacteria (intracellular organism) in blood, skin, and internal organs of the fish. Molecular techniques indicate the bacterium is from the Genus Piscirickettsia, but the species hasn’t yet been determined.

Pertinent questions about the disease in LSC muskellunge?

- How widespread? What is the infection rate? Is it increasing?
- Has/will the disease caused increased mortality?
- What is the source of the disease? Any measure to control it or to prevent spread to other waters?
- Other fish species affected? Do parasites play a role?
- Vertical transmission?
- Could C&R or tournament practices play a role in the spread of the disease?
- Will the infection affect the abundance of muskellunge in the lake?
- What is the species, it's pathology, how related to P. salmonis?

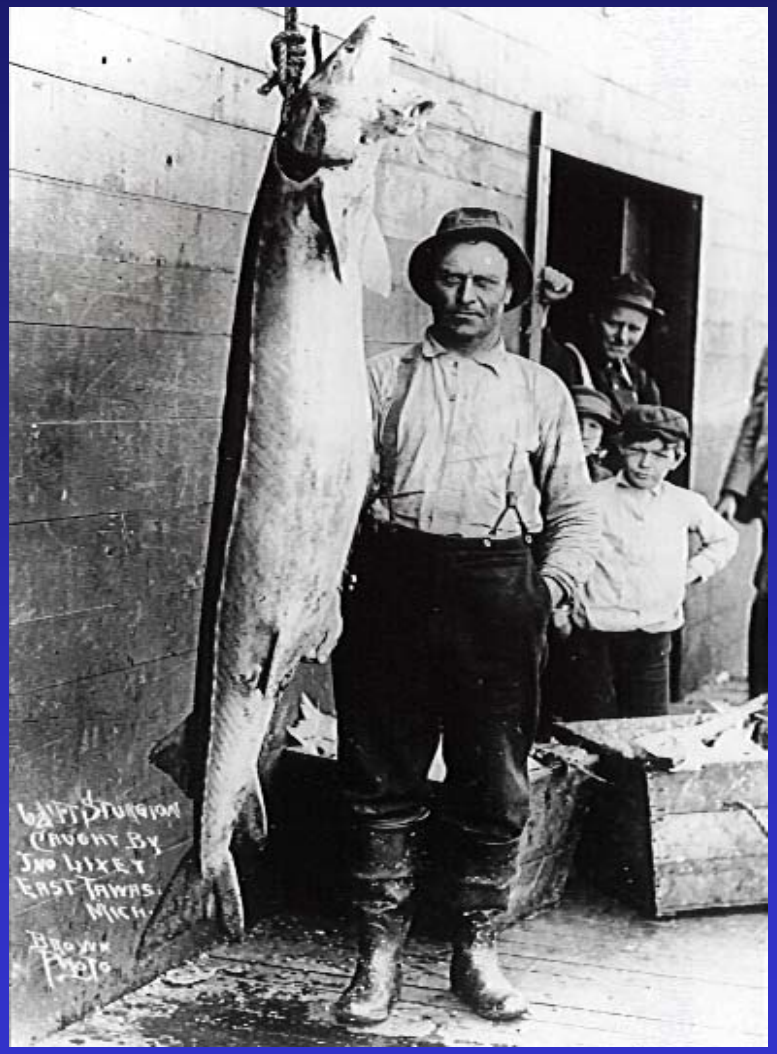
Endangered Fishes

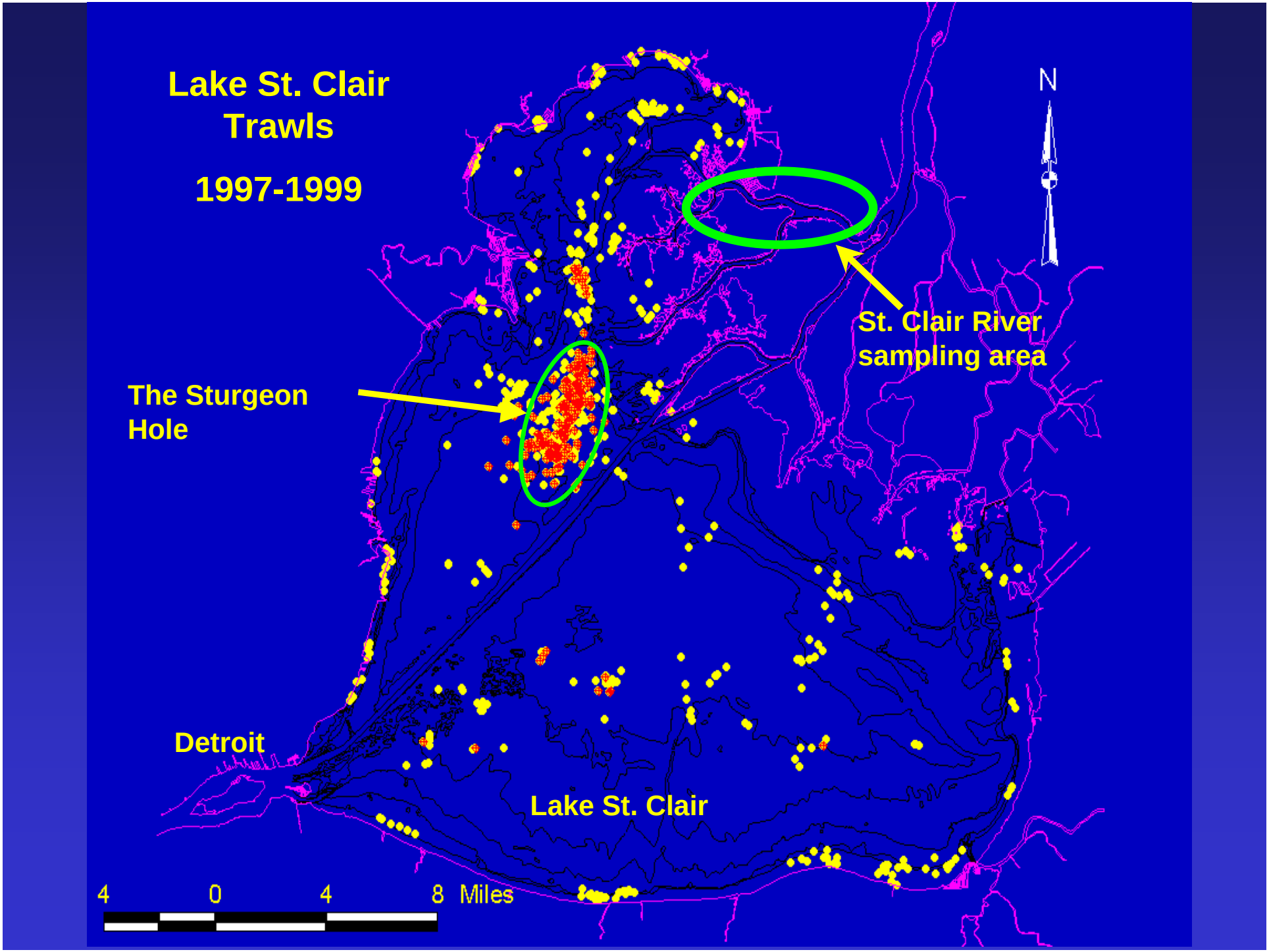
River darter - Endangered

Mooneye - Threatened

Eastern sand darter - Threatened

Lake Sturgeon

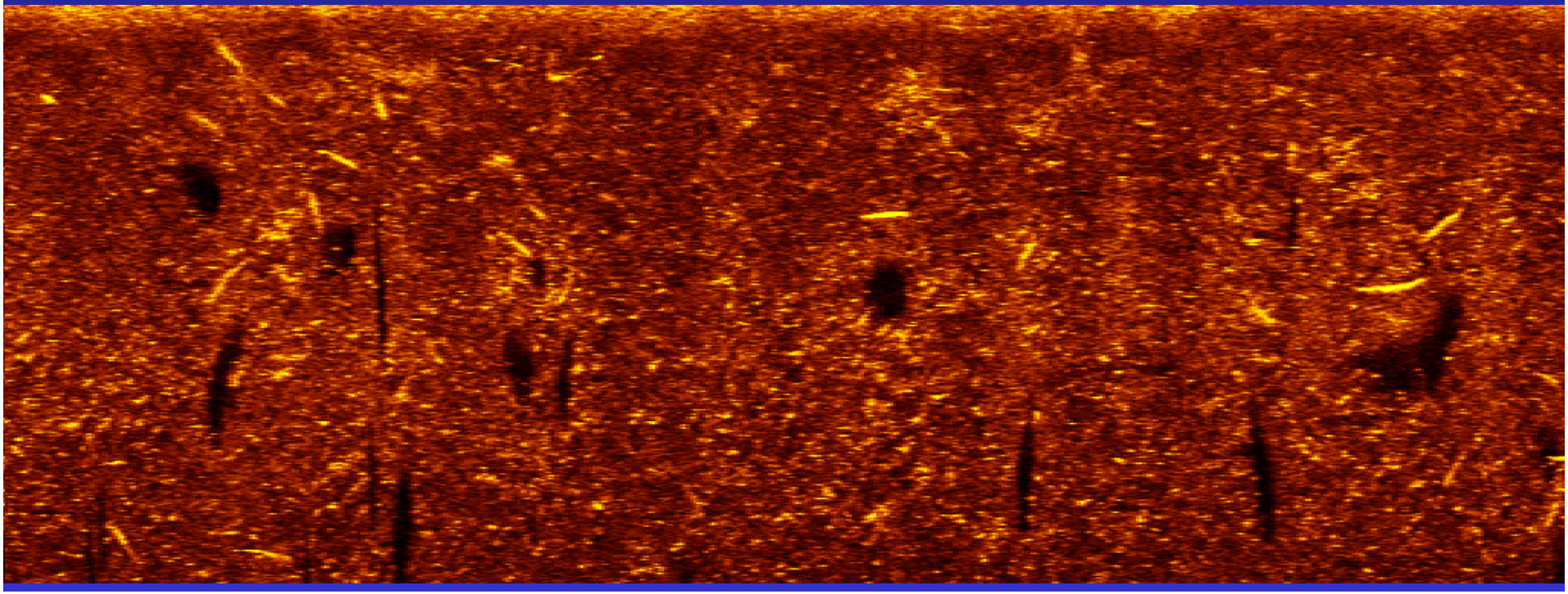



Lake St. Clair
Trawls
1997-1999
N
St. Clair River
sampling area
The Sturgeon
Hole
Detroit
Lake St. Clair
4 0 4 8 Miles

Seascan PC Sidescan Sonar

Single SideScan Image File:
Outlined Polygon: 620 square meters
Number Fish Images: 37
Number Fish Shadows: 30
Mean Length Fish Images: 0.82 m (2.7 ft.)
Length Range: 0.4 m (1.1 ft.) to 2.5 m (8.1 ft.)
Approx. Fish Height from Bottom: 0.8 m (2.6 ft.)

Direction of towfish movement →



Lake Sturgeon

- Tagging Studies suggest 24,000 to 86,000 Fish Present
- One of largest populations in Great Lakes
- Focus of restoration efforts

Issues: Aquatic Plants

Wild Celery

- **Aquatic plants have increased**
- **Plant increase associated with increases in smallmouth bass, muskellunge, yellow perch**
- **Plants provide nutrients, habitat, stabilize sediment, improve water transparency**
- **Occasional die-offs cause nuisance conditions, public demand for control**

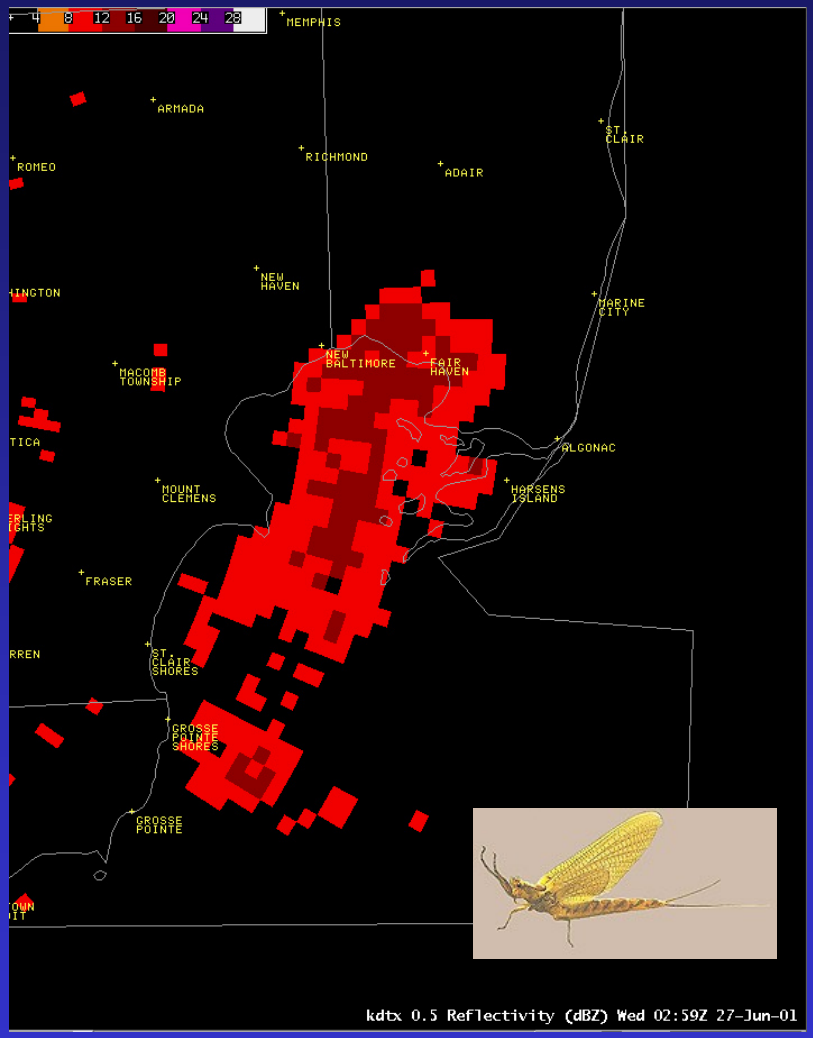
Issues: Exotic Species

- Zebra mussels
  - -high abundance
  - -Filter water column
  - -Few obvious direct effects on Lake St. Clair Fish community

- Round goby
  - -high abundance
  - -causing decline in benthic fishes
  - -Consumes zebra mussels
  - -Eaten by many game fishes

Issues: Mayflies

- Biologists love them
  - Important food source for fish
  - Indicator of ecosystem health
- This feeling is not always shared
  - Mating swarms are a nuisance



National Weather Service Doppler Radar

The Lake St. Clair Fish Community is Healthy

- High Diversity
  - High diversity, most original species present
  - Lake sturgeon stable, possibly increasing
- Sport Fishing
  - Muskellunge, smallmouth bass, yellow perch
  - Associated with increase in aquatic plants
  - Significant economic impact to region
- Issues- Mayflies and Plants
  - What is good for fish is not always perfect for humans


Saginaw Bay

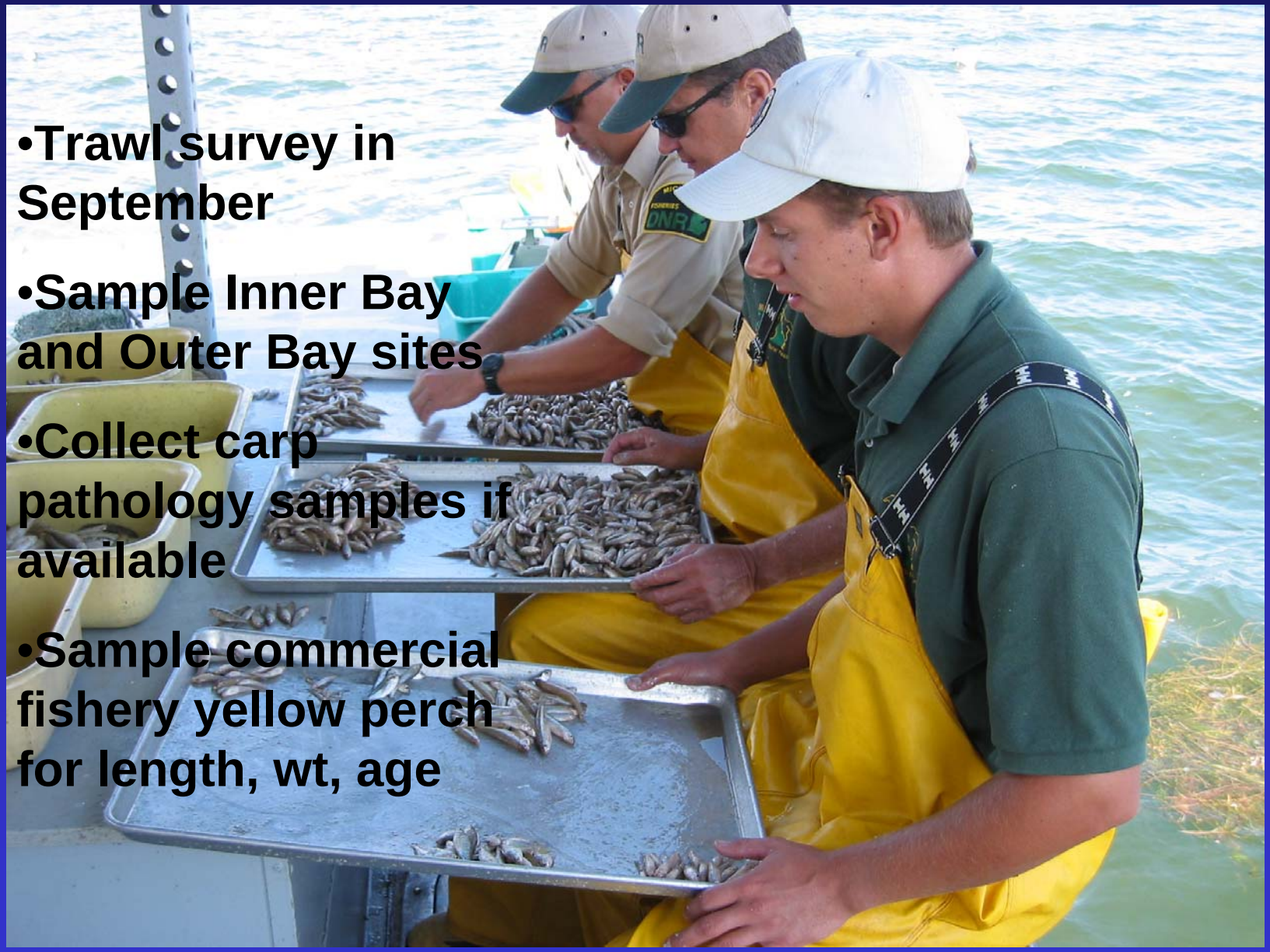
Study 466 Trawl Update - 2003

Study Objective: To assess responses of the Saginaw Bay fish community to changing environmental and biological conditions. Of specific interest is the monitoring of fish community responses to management actions and the effects of nonnative species and the gauging of walleye recruitment and population growth.

Spottail shiner was the most abundant species in the 2002 fall trawls, with 32,931 captured for a mean cpue of 967 fish per 10 minute tow.

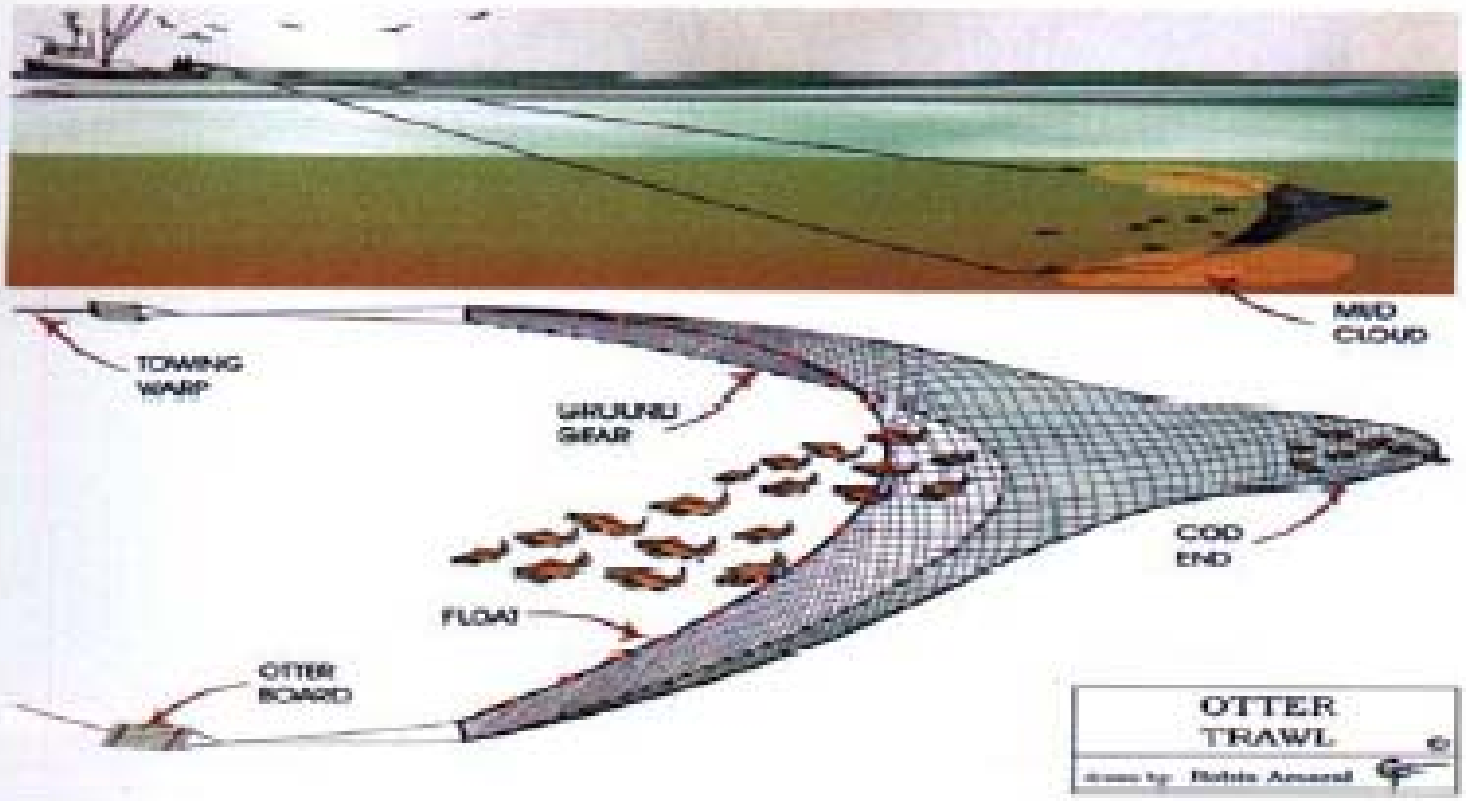
Mt. Clemens Fisheries Research Station

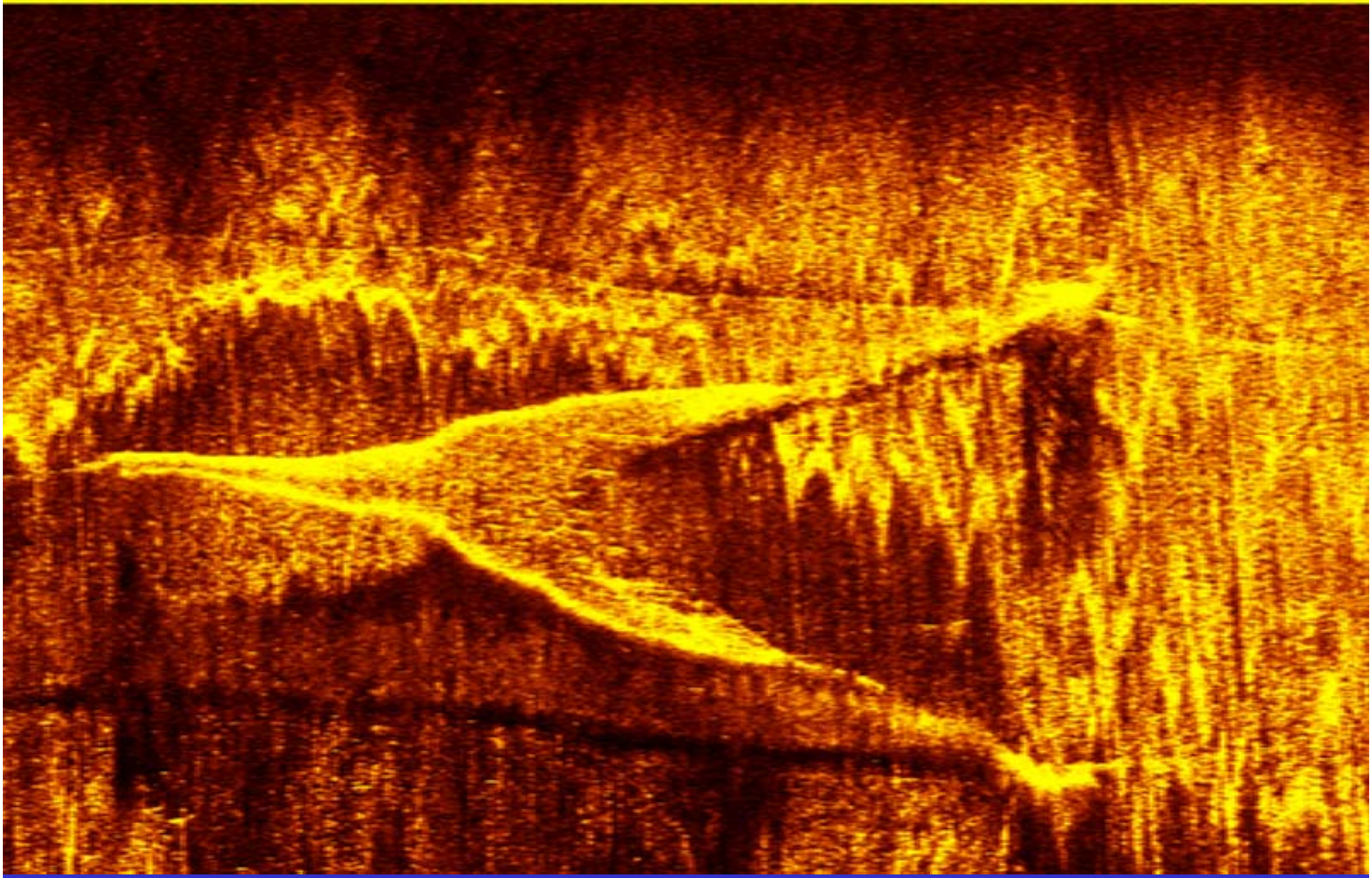
Mt. Clemens Saginaw Bay 2002 & 2003 Sampling



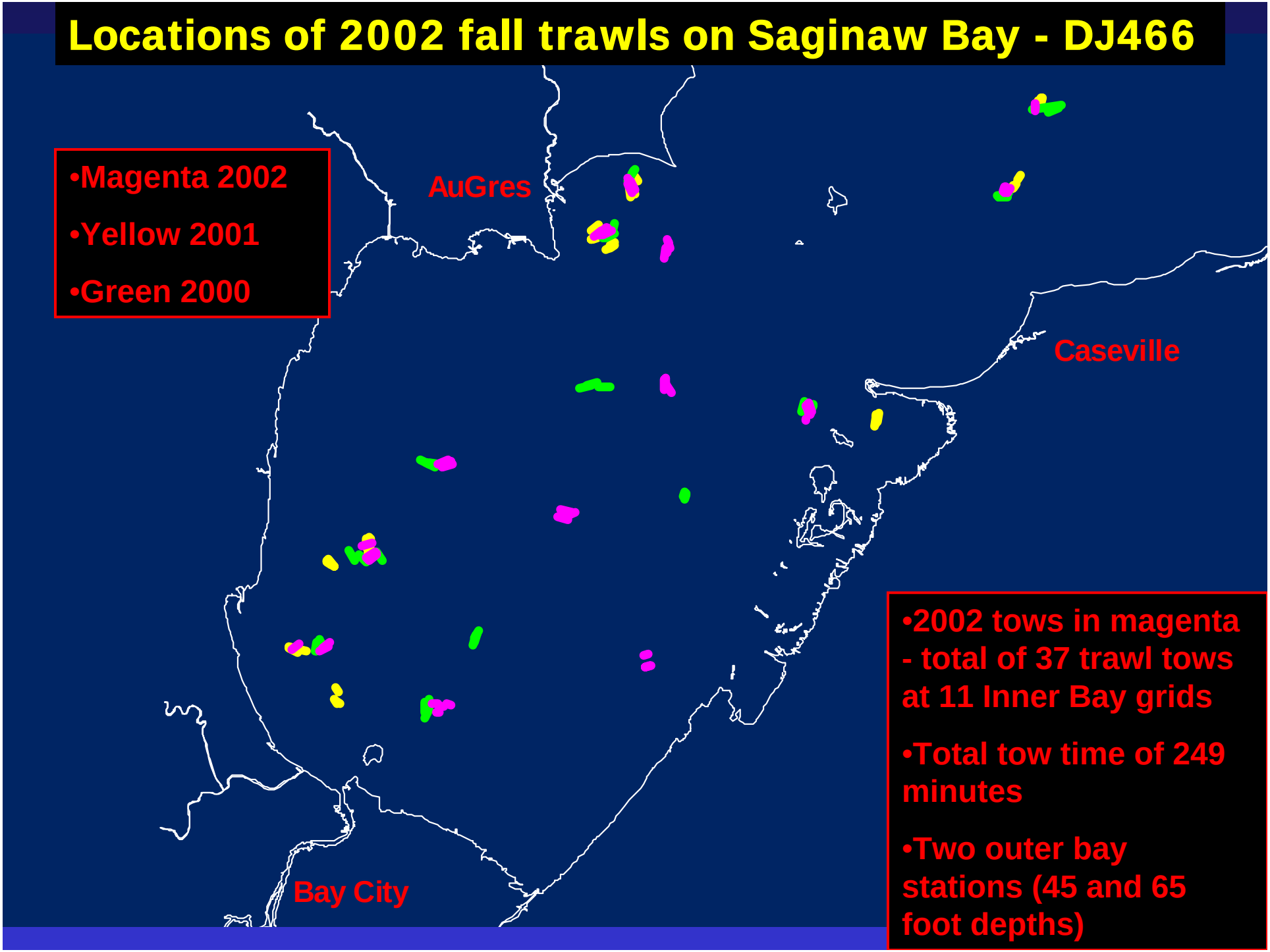
- Trawl survey in September
- Sample Inner Bay and Outer Bay sites
- Collect carp pathology samples if available
- Sample commercial fishery yellow perch for length, wt, age

SMOLOWITZ
FIGURE 3
(page 49)
A bottom
trawl.
Drawing
by Robin
Amaral.



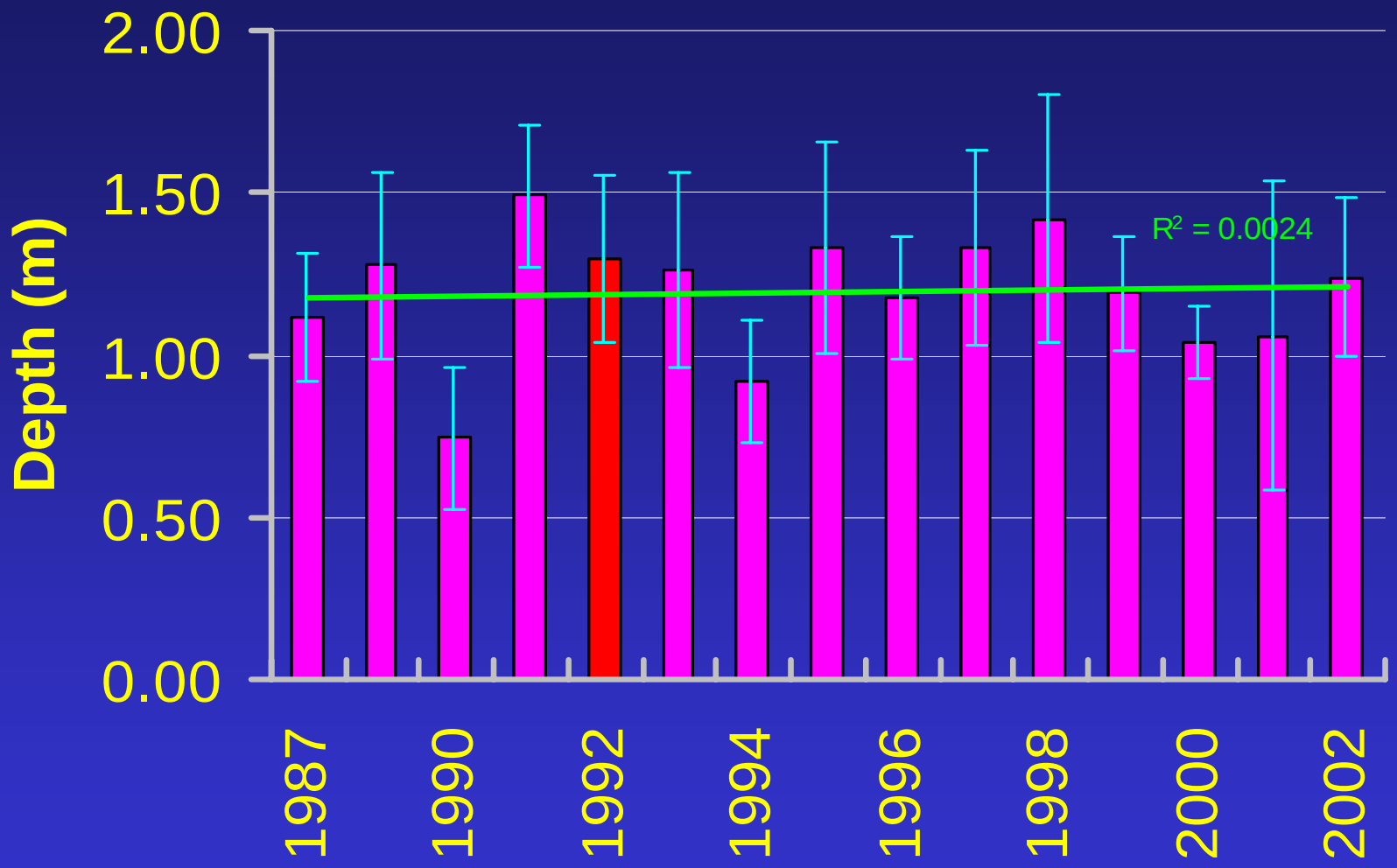


Locations of 2002 fall trawls on Saginaw Bay - DJ466



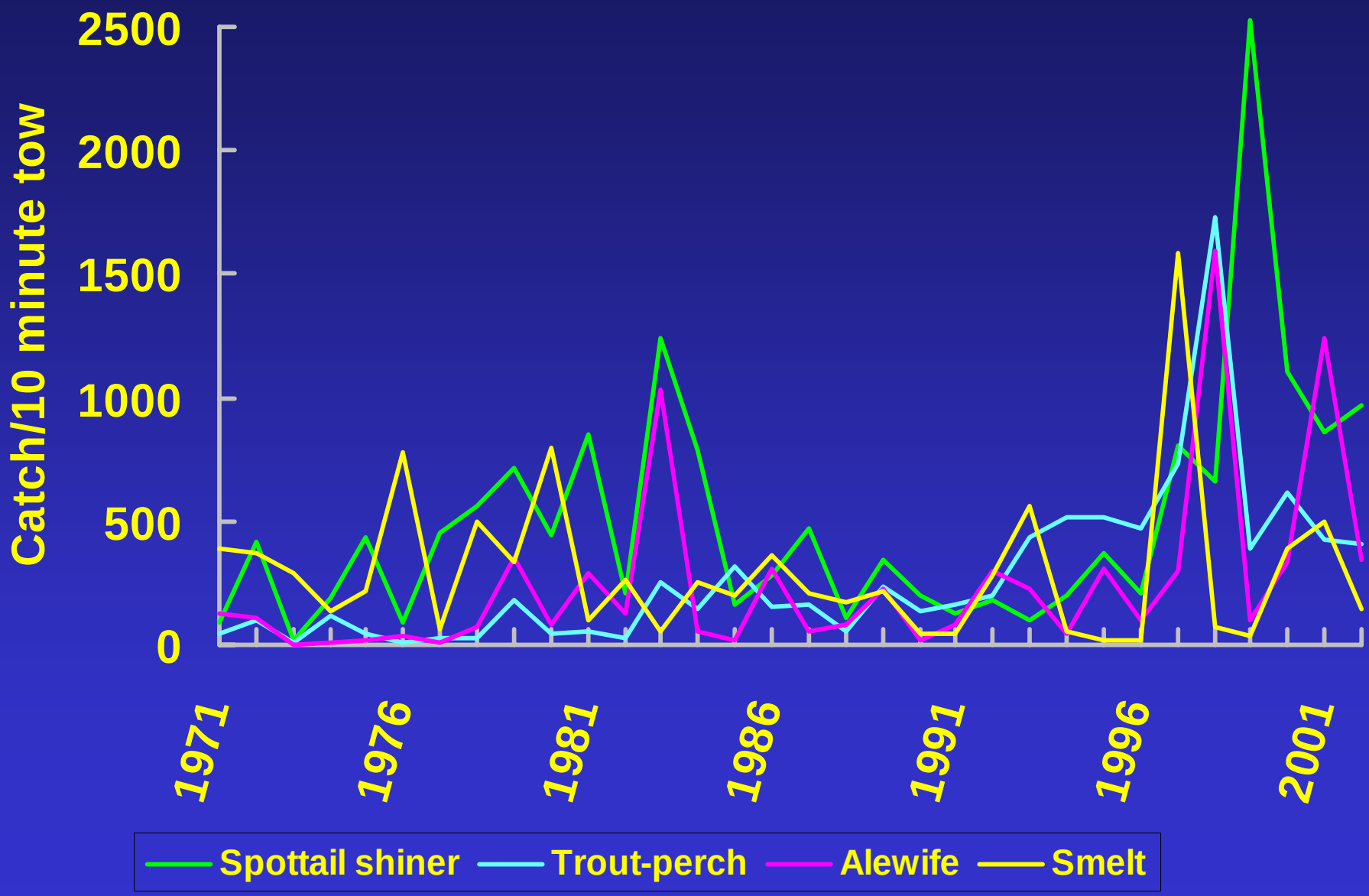
Mean secchi depth for SB fall trawl surveys

(Inner Bay Only)

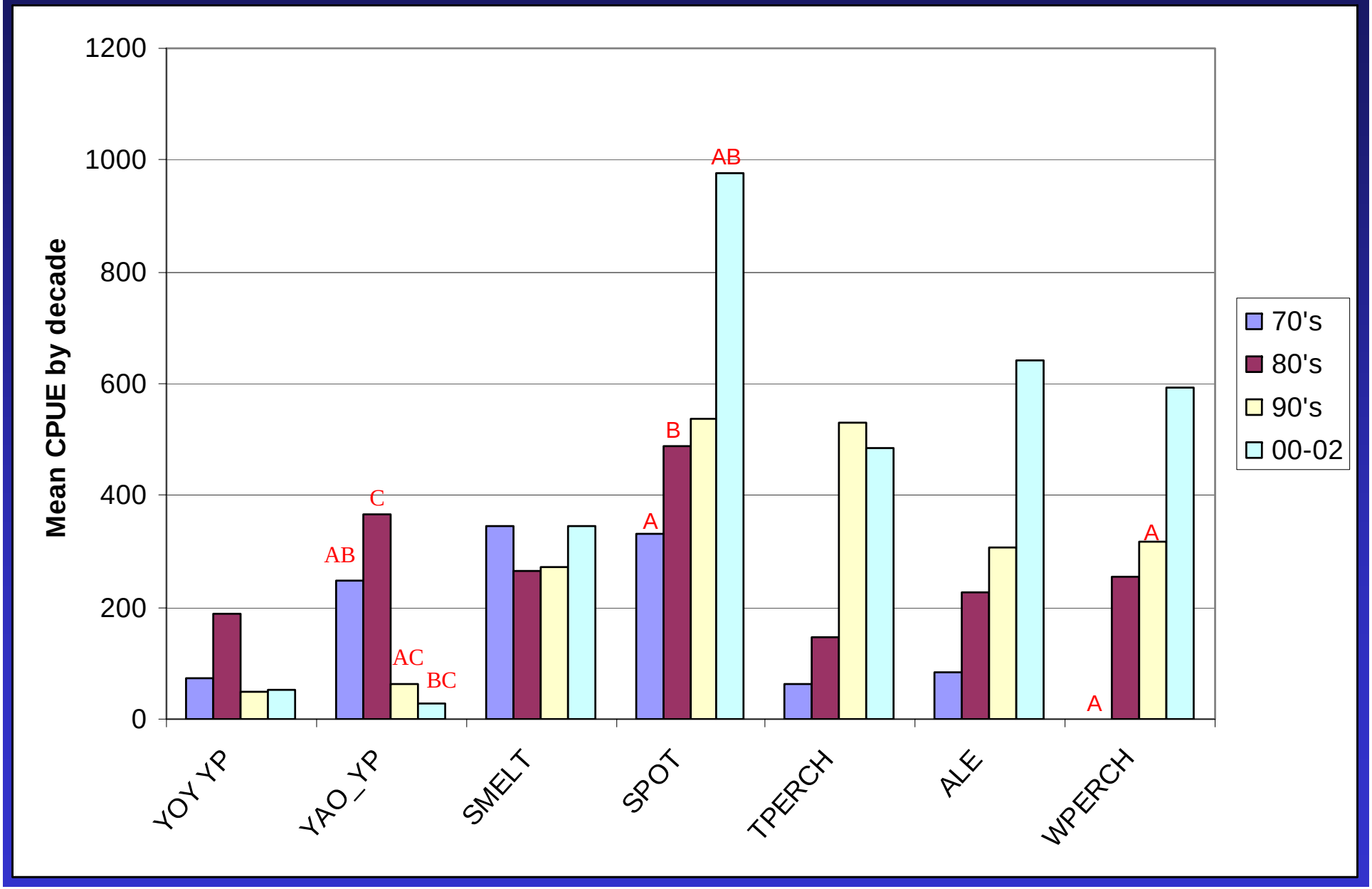


No statistically significant trend in secchi depths.

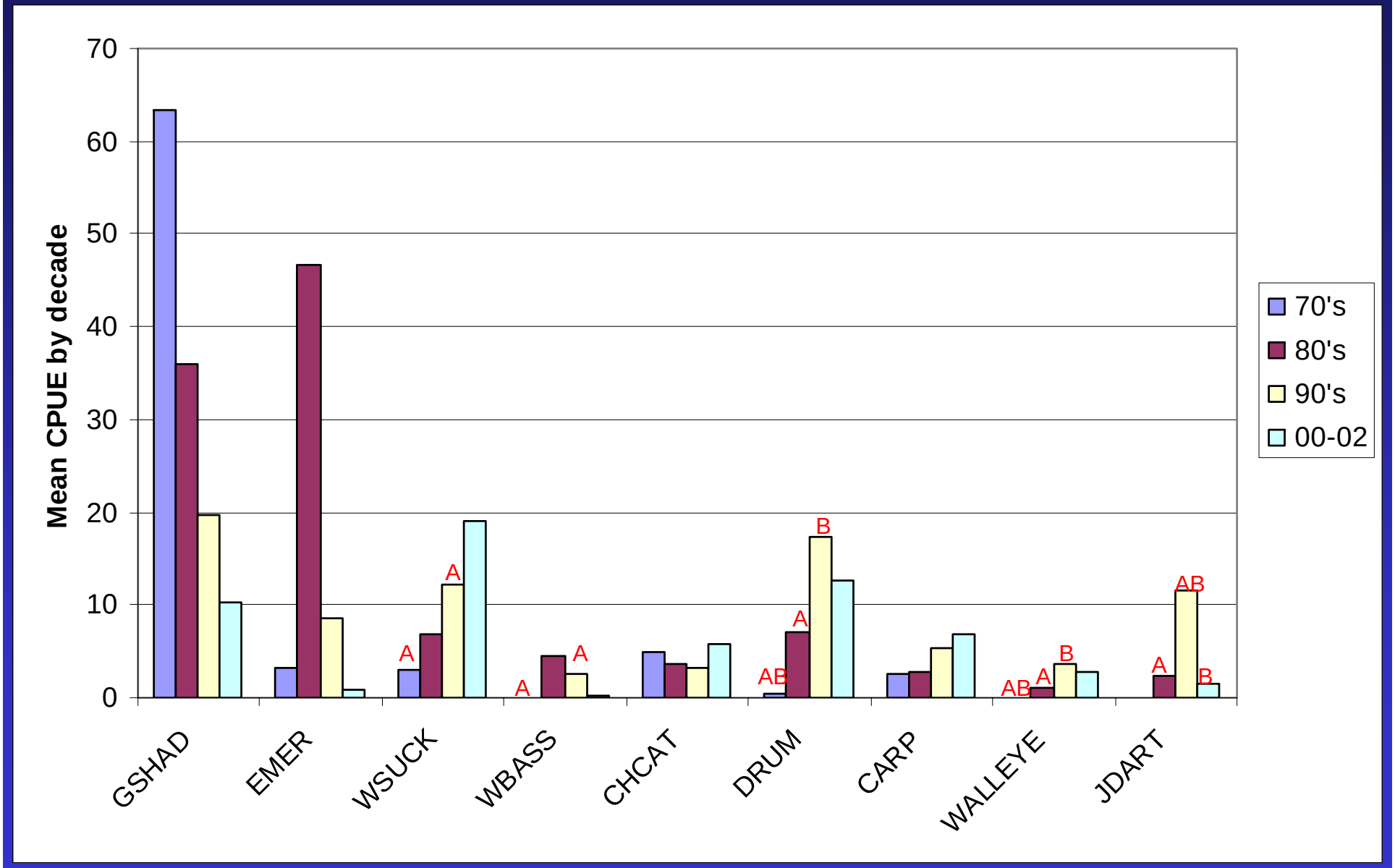
Thirty-two Year Data Time Series of Fall Trawl CPUE for 4 soft-rayed forage species



Comparison of Decade Mean CPUE for primary species captured in fall trawls on Saginaw Bay



Comparison of Decade Mean CPUE for primary species captured in fall trawls on Saginaw Bay



Round goby catch rates declined slightly in 2002 – only 1 johnny darter caught in 35 trawl tows

385.3

Round goby CPUE

450
400
350
300
250
200
150
100
50
0

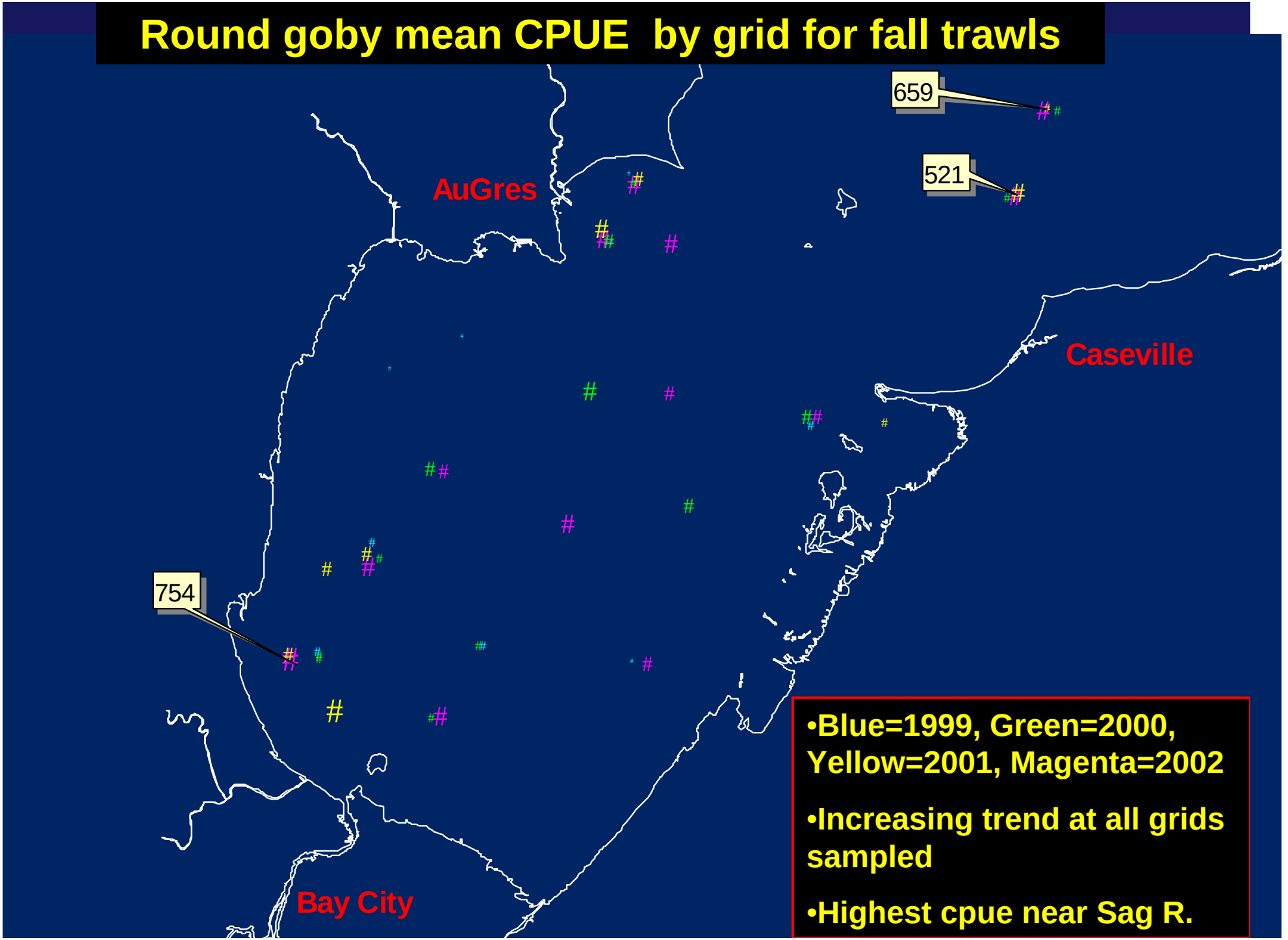
Johnny darter CPUE

35
30
25
20
15
10
5
0

1986
1989
1992
1995
1998
2001

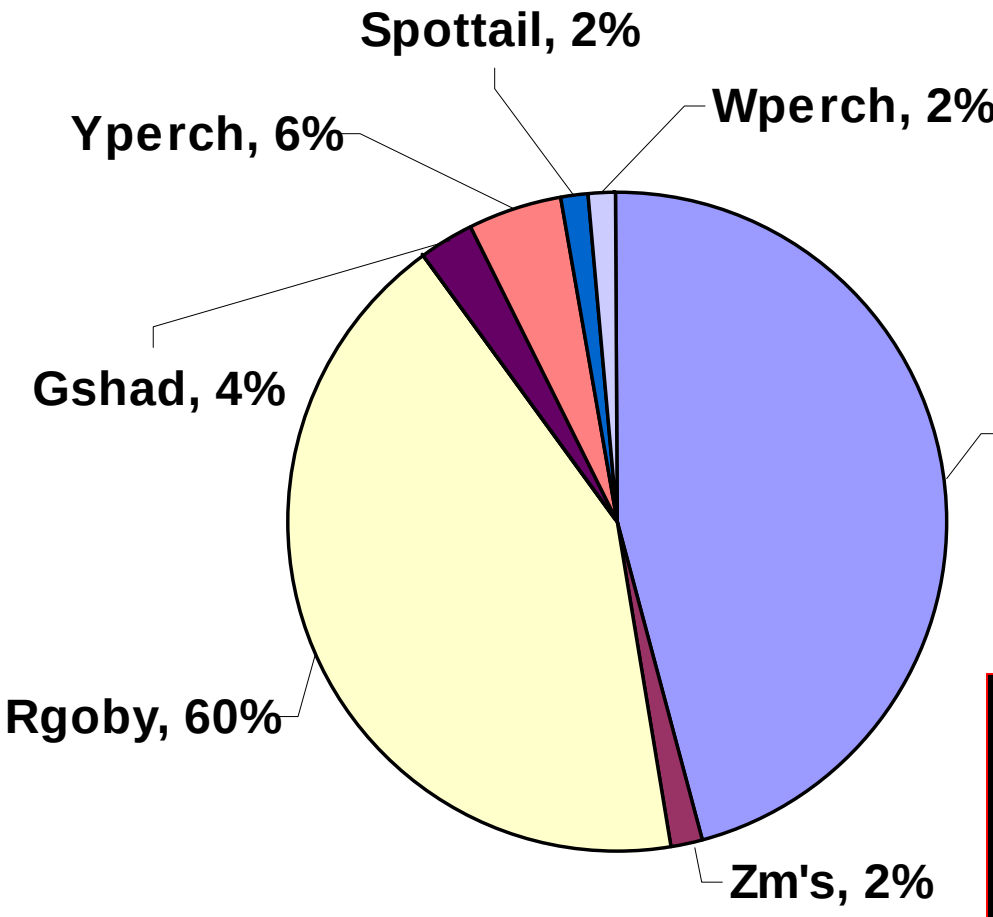
Round goby
Johnny darter

Round goby mean CPUE by grid for fall trawls



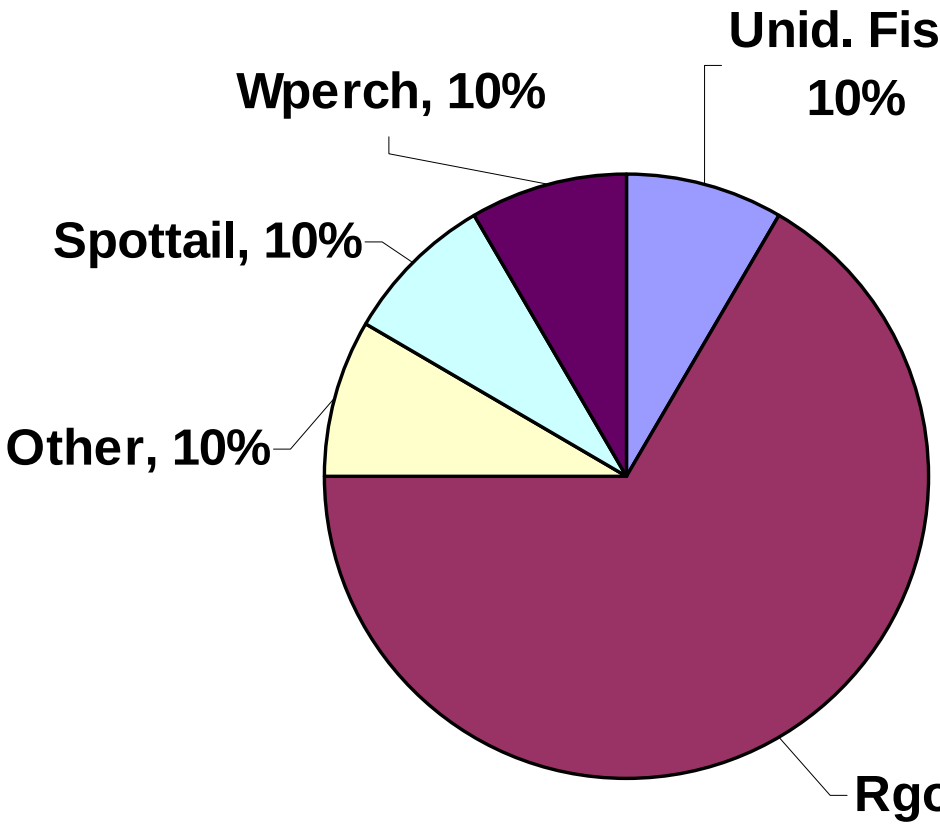
- Blue=1999, Green=2000, Yellow=2001, Magenta=2002
- Increasing trend at all grids sampled
- Highest cpue near Sag R.

Diet of Freshwater Drum from Saginaw Bay (expressed as frequency of occurrence)



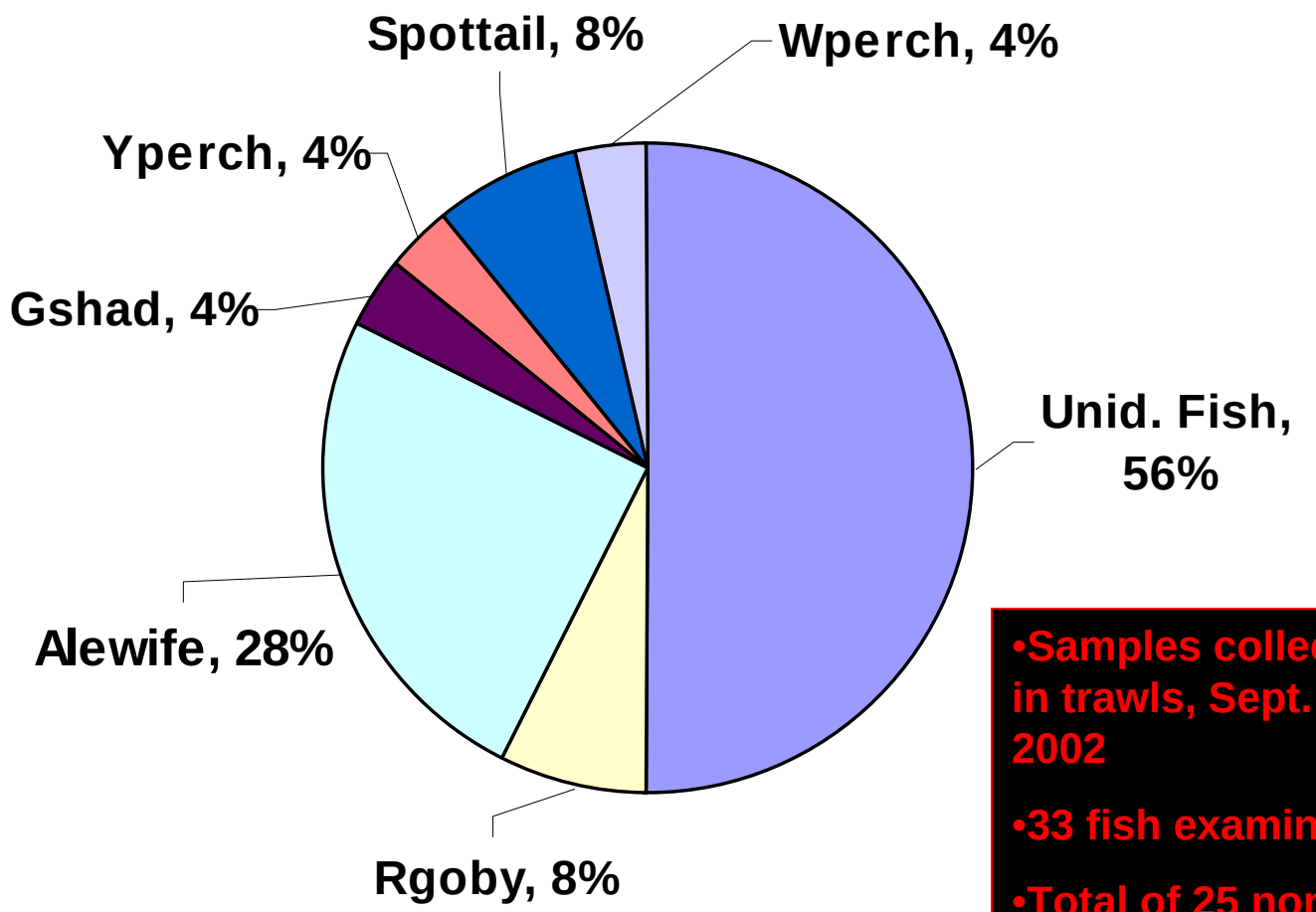
- Samples collected in trawls, Sept. 2002
- 88 fish examined
- Total of 50 non-empty stomachs

Diet of Channel Catfish from Saginaw Bay (expressed as frequency of occurrence)



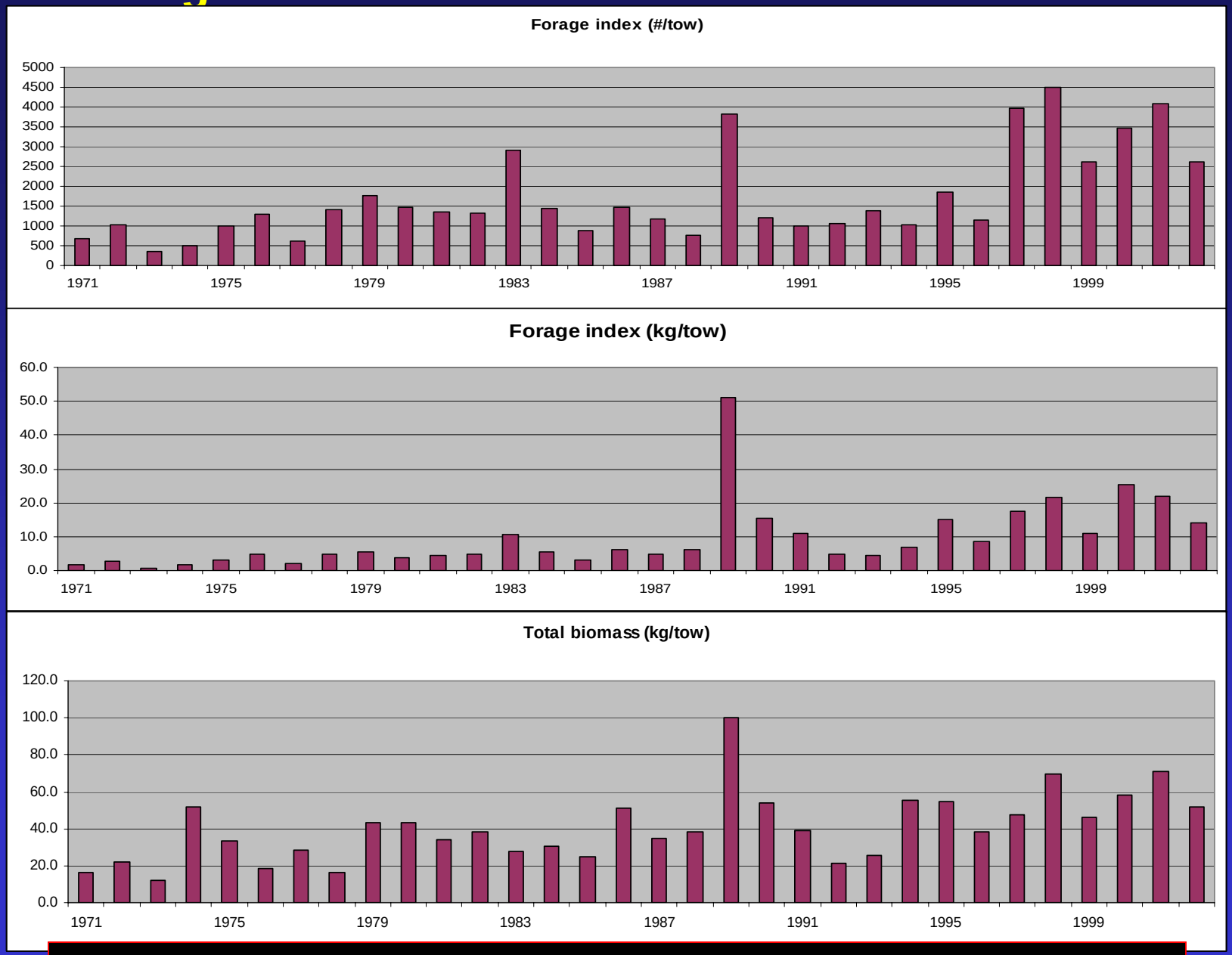
- Samples collected in trawls, Sept. 2002
- 19 fish examined
- Total of 10 non-empty stomachs

Diet of YAO Walleye from Saginaw Bay (expressed as frequency of occurrence)



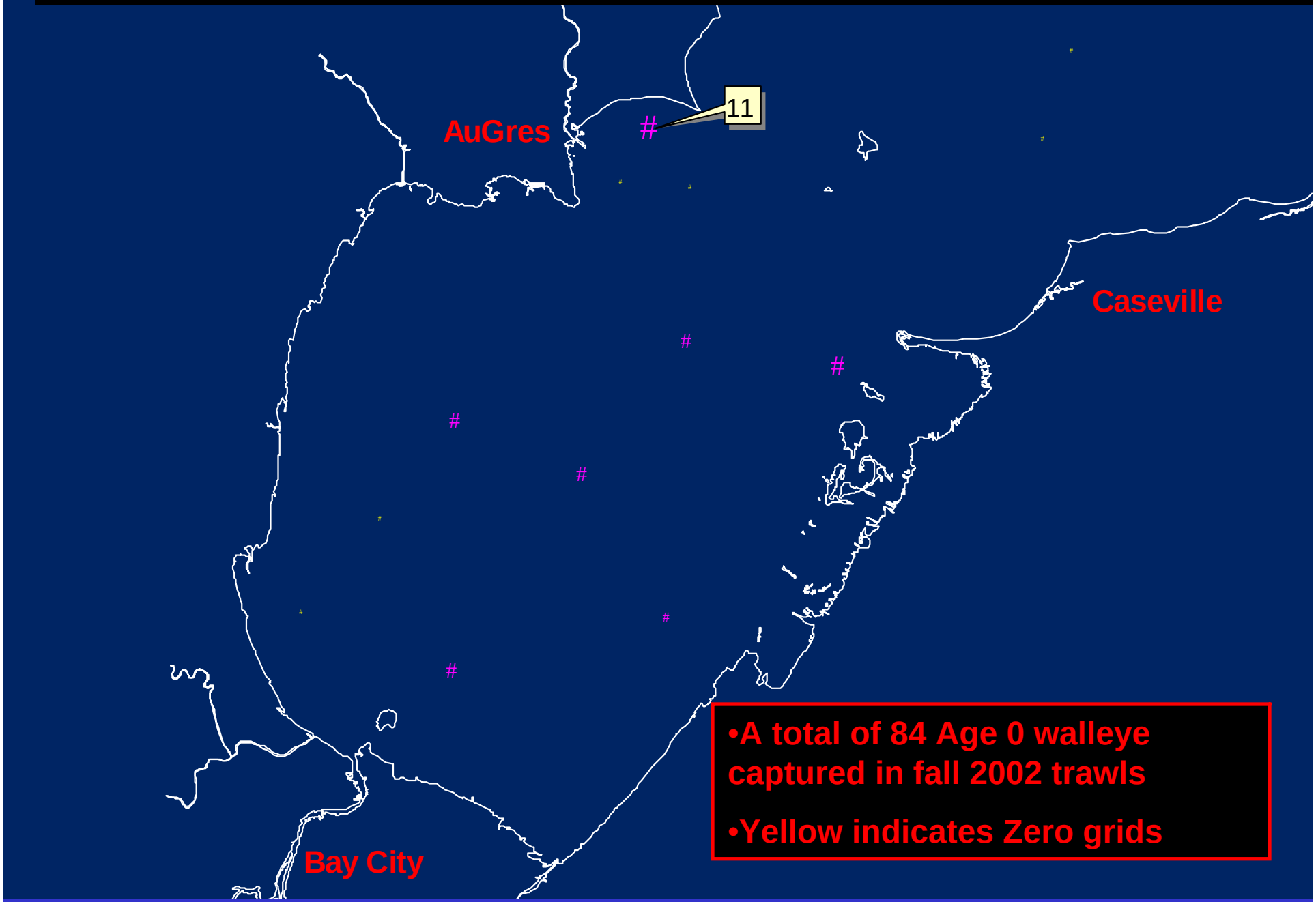
- Samples collected in trawls, Sept. 2002
- 33 fish examined
- Total of 25 non-empty stomachs

SB Forage index and total biomass based on fall trawls



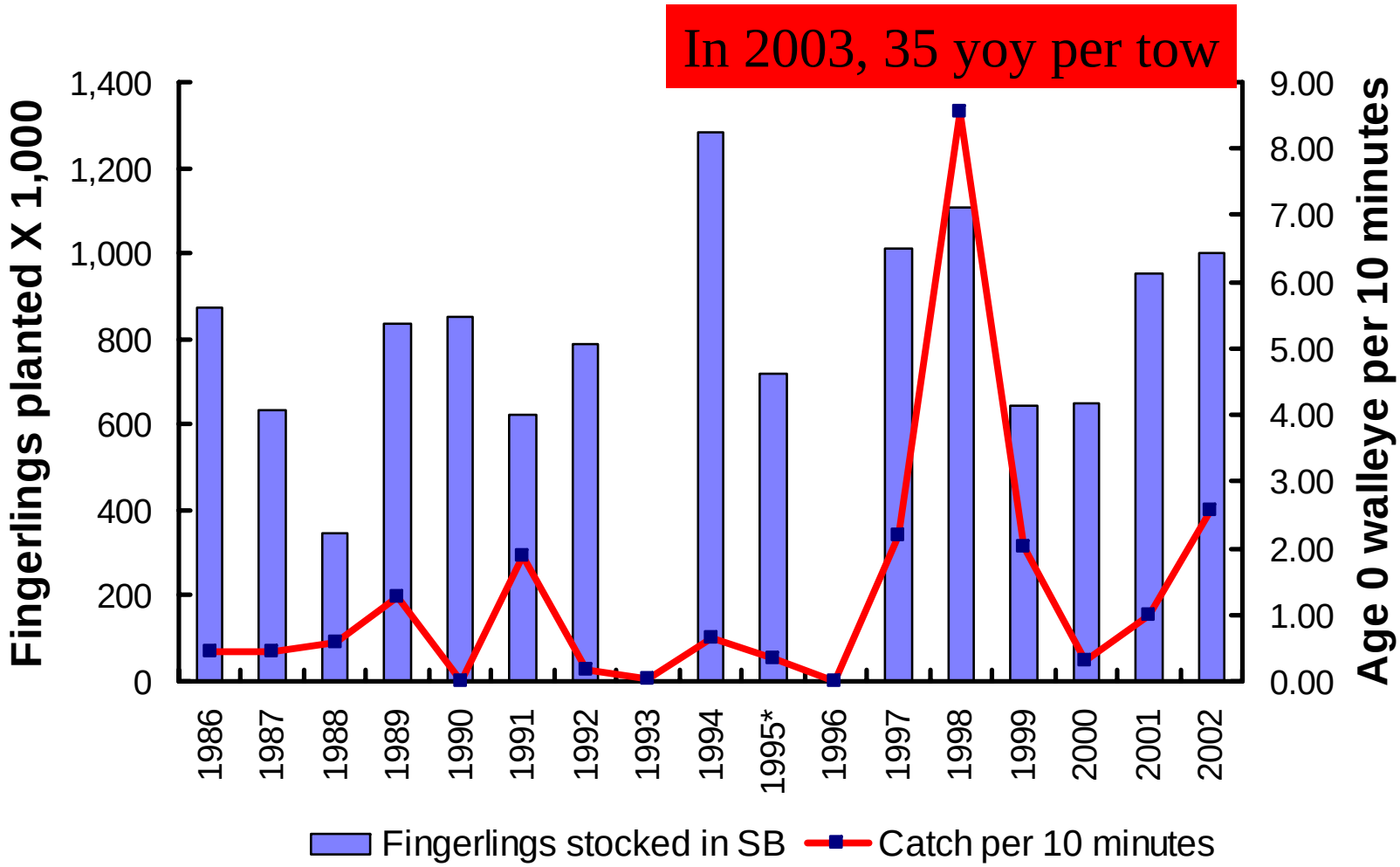
Forage index species include: Alewife, Emerald shiner, Gizzard Shad, Smelt, Spottail shiner, Round goby, Trout-perch, White bass, White perch, Age 0 Yellow Perch

Age 0 walleye mean CPUE by Grid - 2002

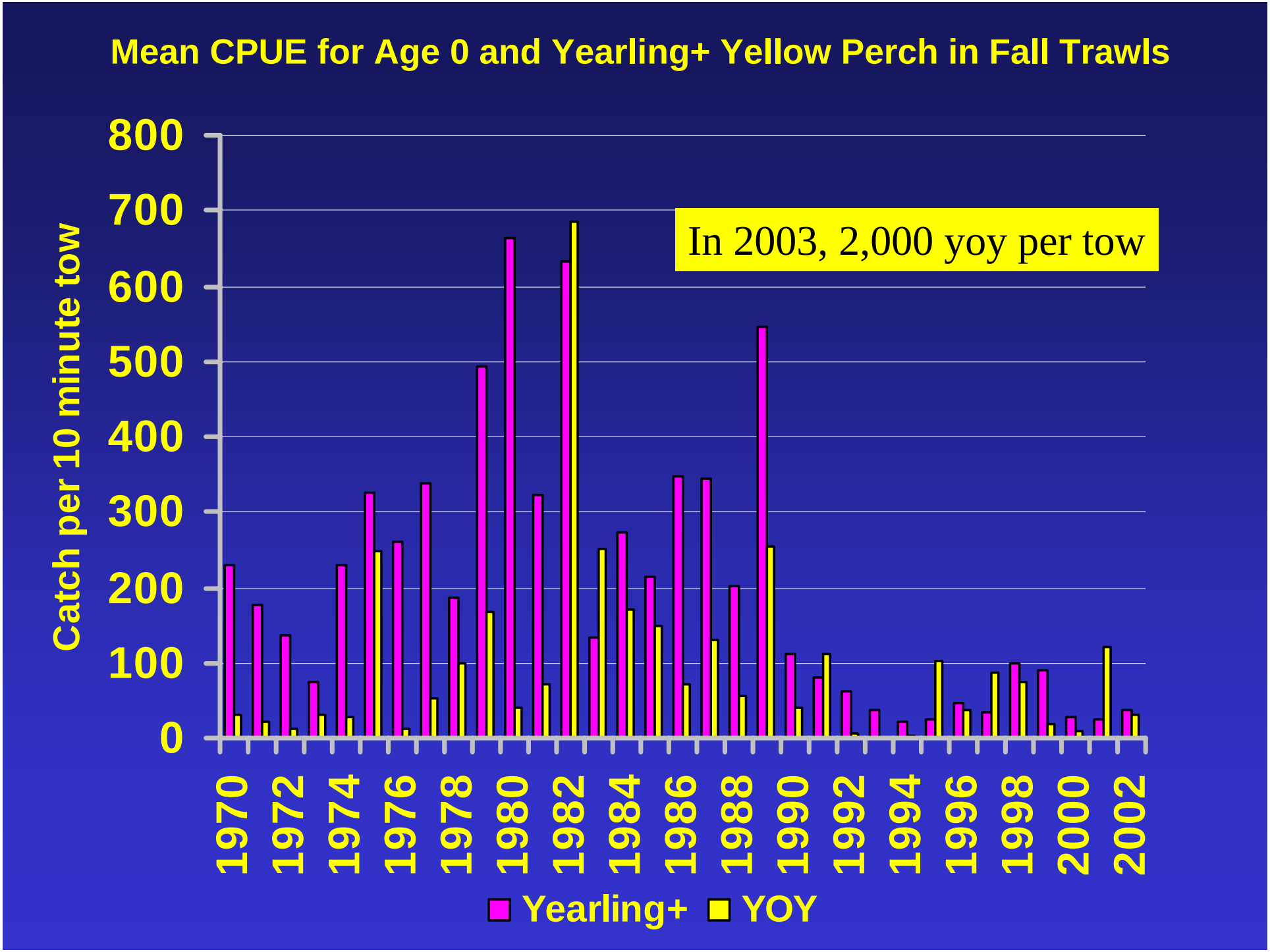


- A total of 84 Age 0 walleye captured in fall 2002 trawls
- Yellow indicates Zero grids

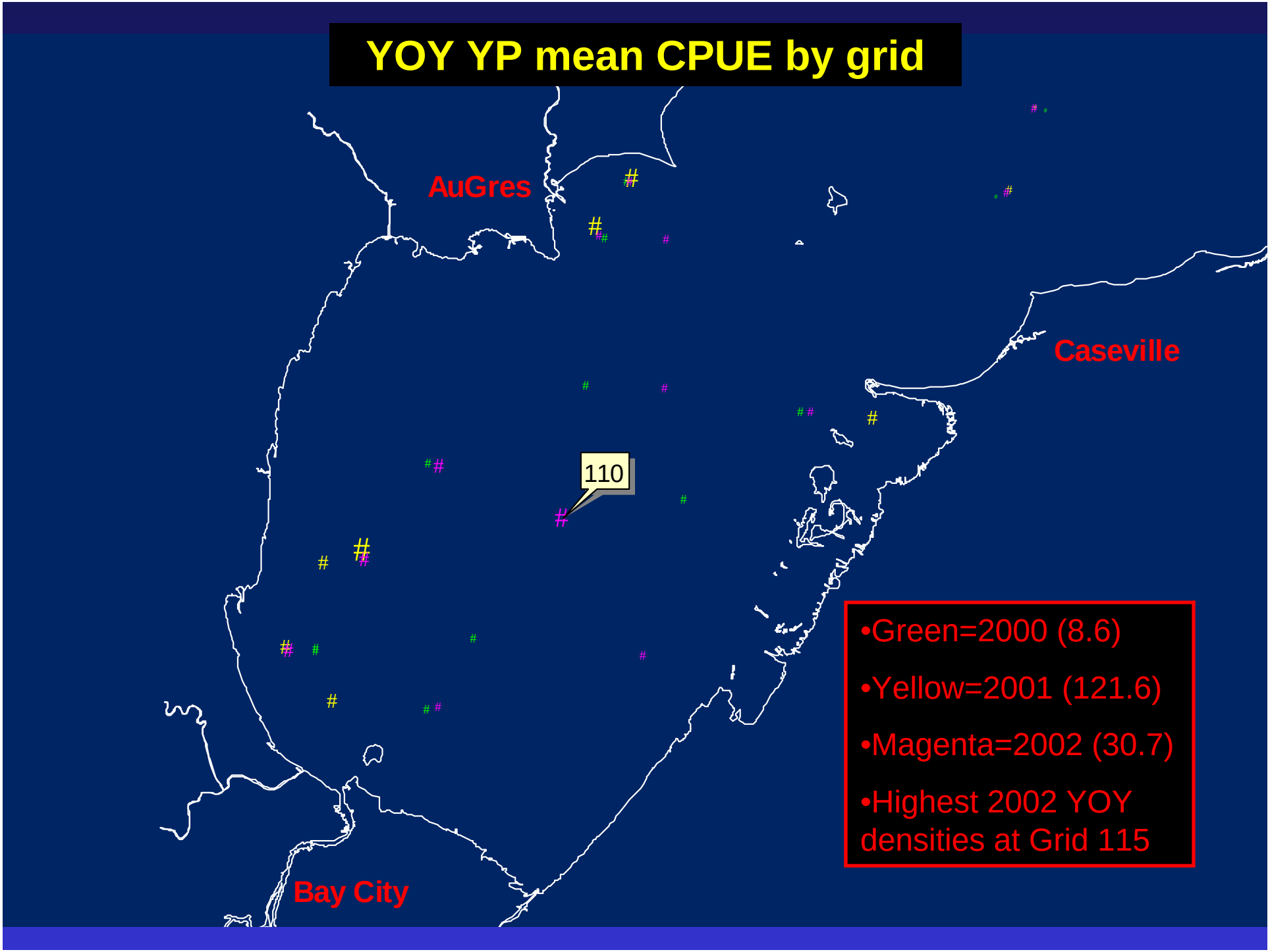
Age 0 Walleye CPUE for SB Fall Trawls and Walleye Fingerlings Stocked in SB



2002 trawl CPUE of 2.54 per 10 minute tow expands out to an estimated bay population of 838,888 Age 0 walleye

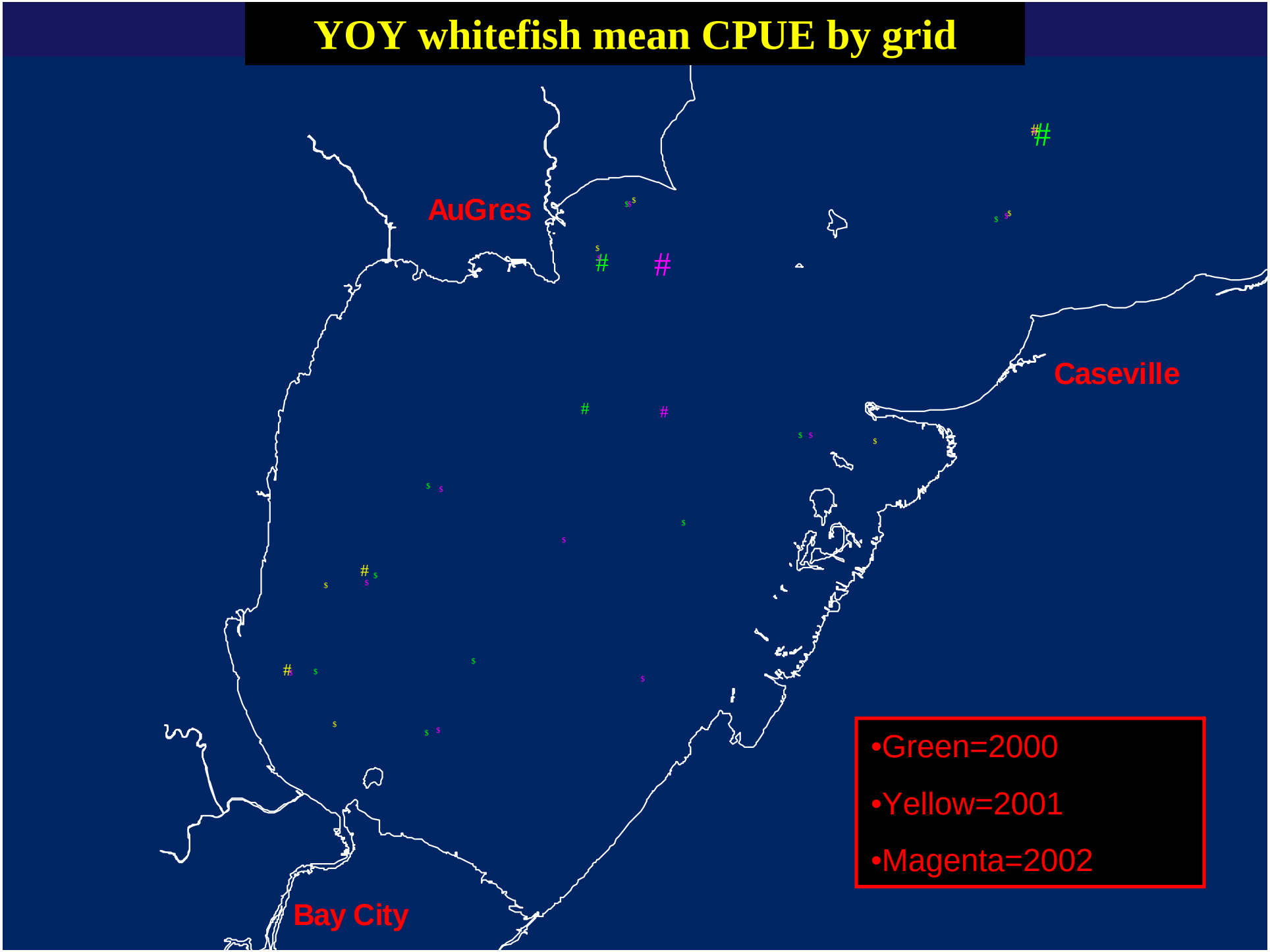

Mean CPUE for Age 0 and Yearling+ Yellow Perch in Fall Trawls
Catch per 10 minute tow
800
700
600
500
400
300
200
100
0
In 2003, 2,000 yoy per tow
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
Yearling+
YOY

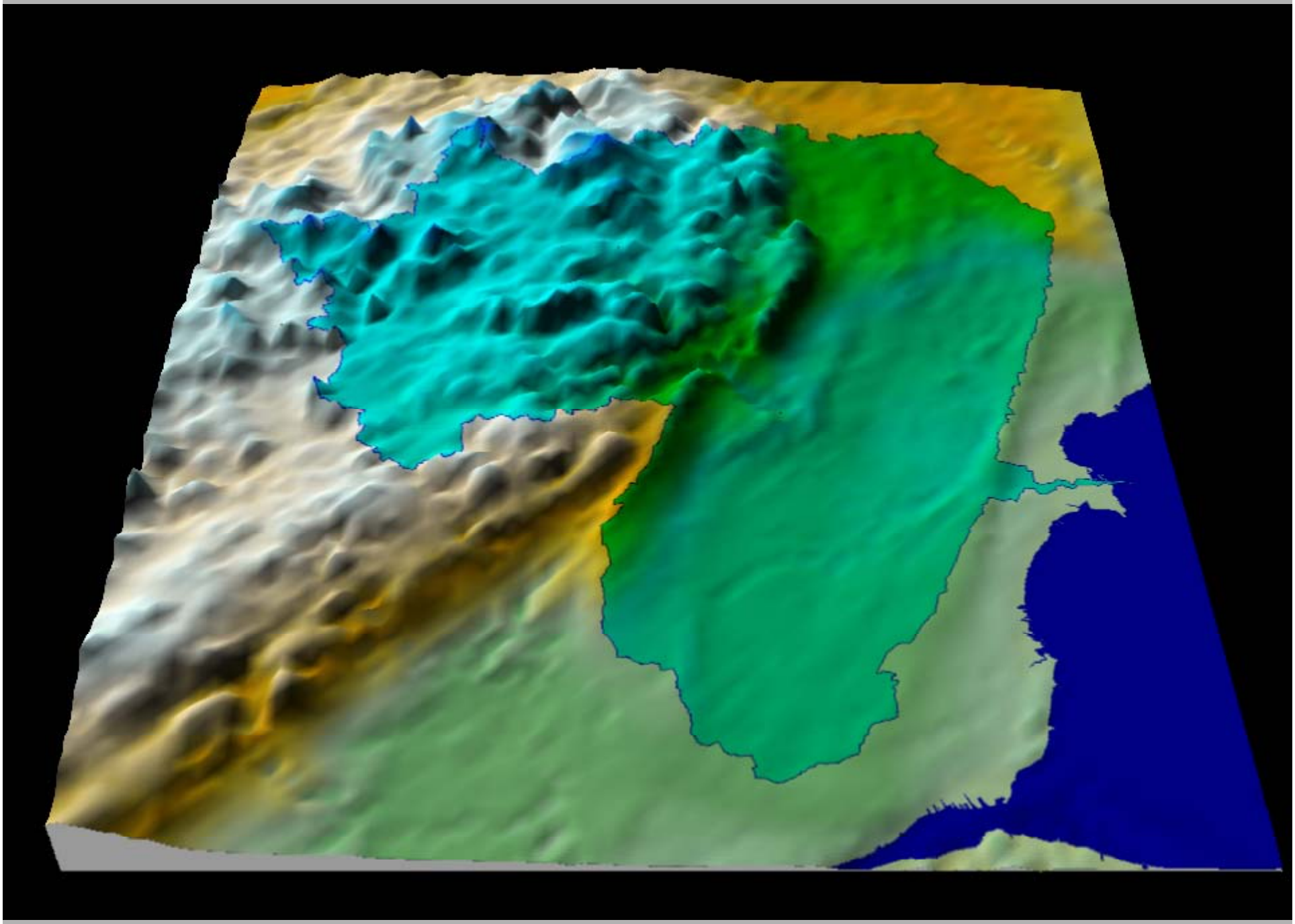
YOY YP mean CPUE by grid



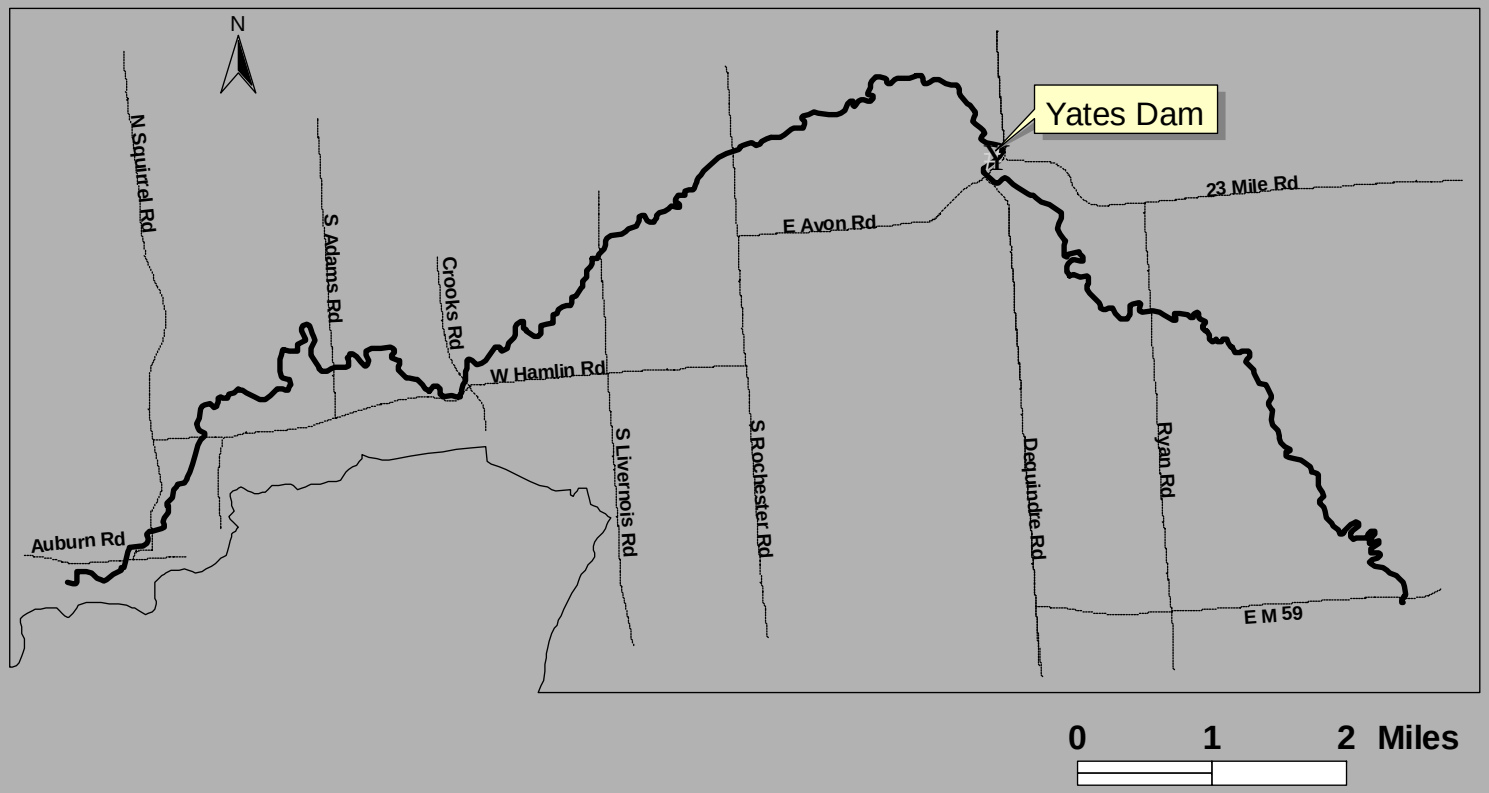
- Green=2000 (8.6)
- Yellow=2001 (121.6)
- Magenta=2002 (30.7)
- Highest 2002 YOY densities at Grid 115

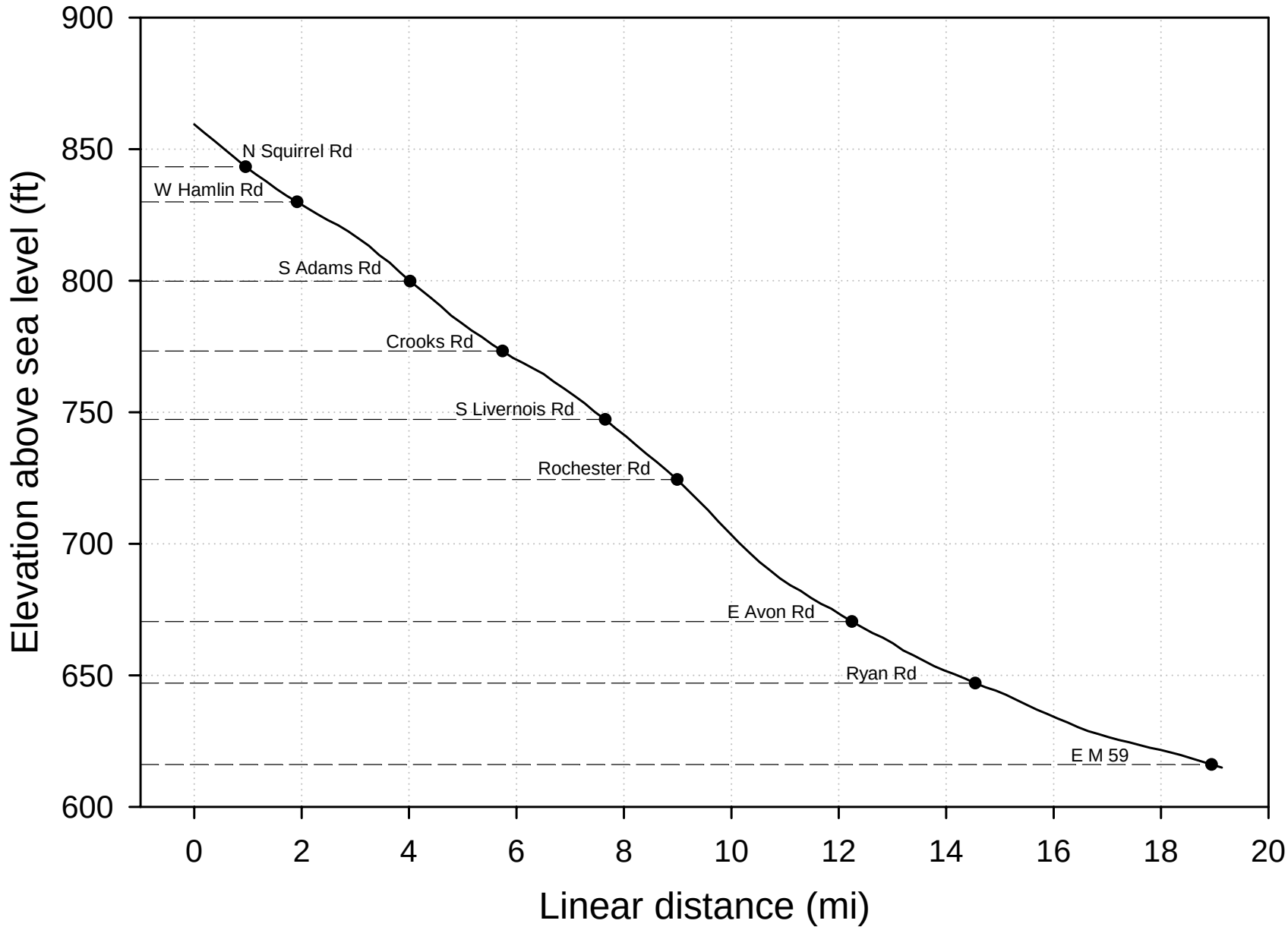
YOY whitefish mean CPUE by grid



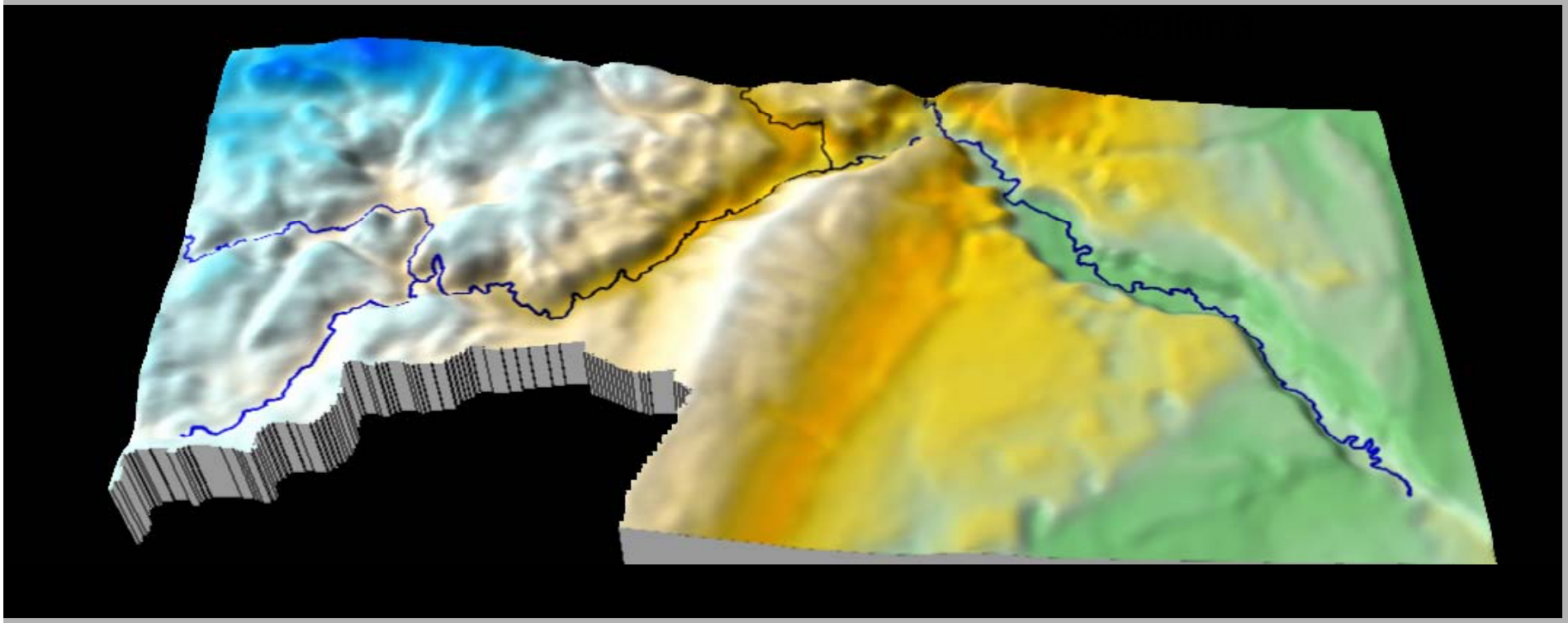


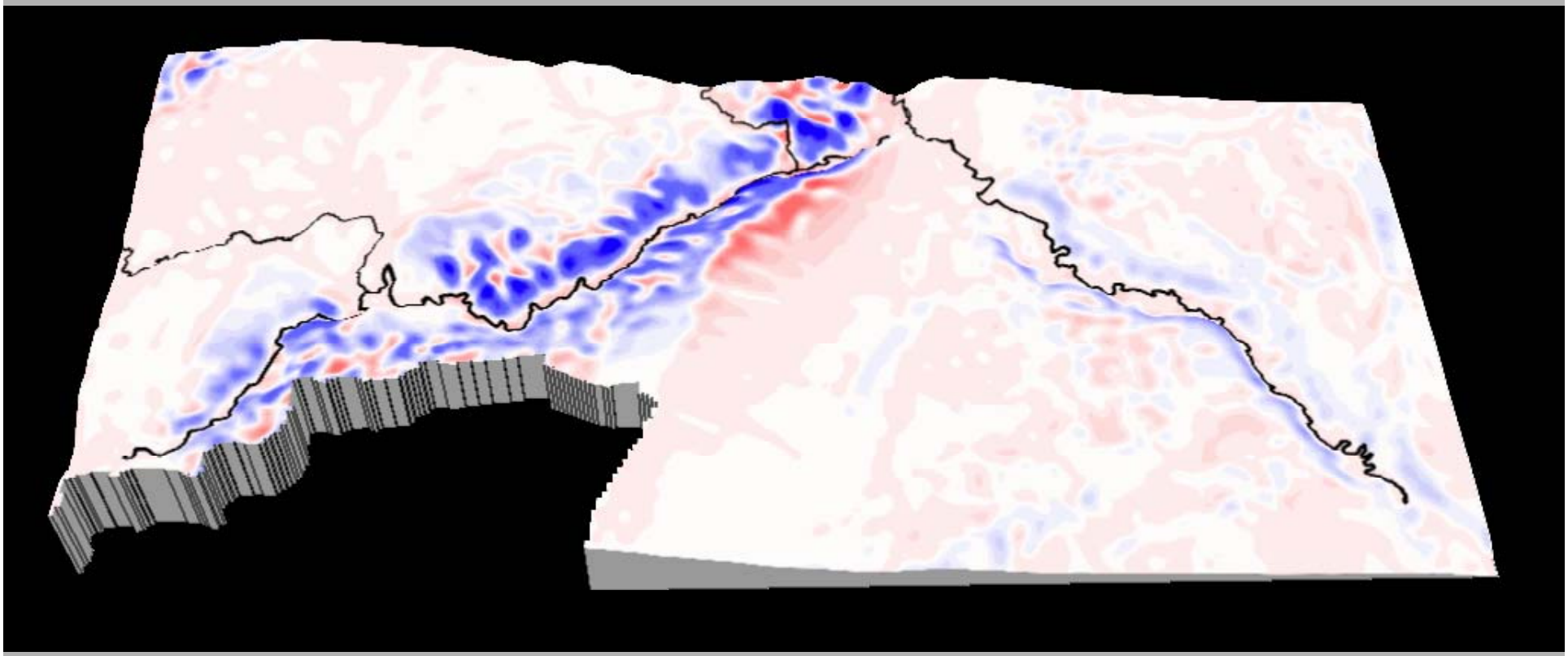
Clinton River
Section 3




900
850
800
750
700
650
600
Elevation above sea level (ft)
N Squirrel Rd
W Hamlin Rd
S Adams Rd
Crooks Rd
S Livernois Rd
Rochester Rd
E Avon Rd
Ryan Rd
E M 59
0
2
4
6
8
10
12
14
16
18
20
Linear distance (mi)

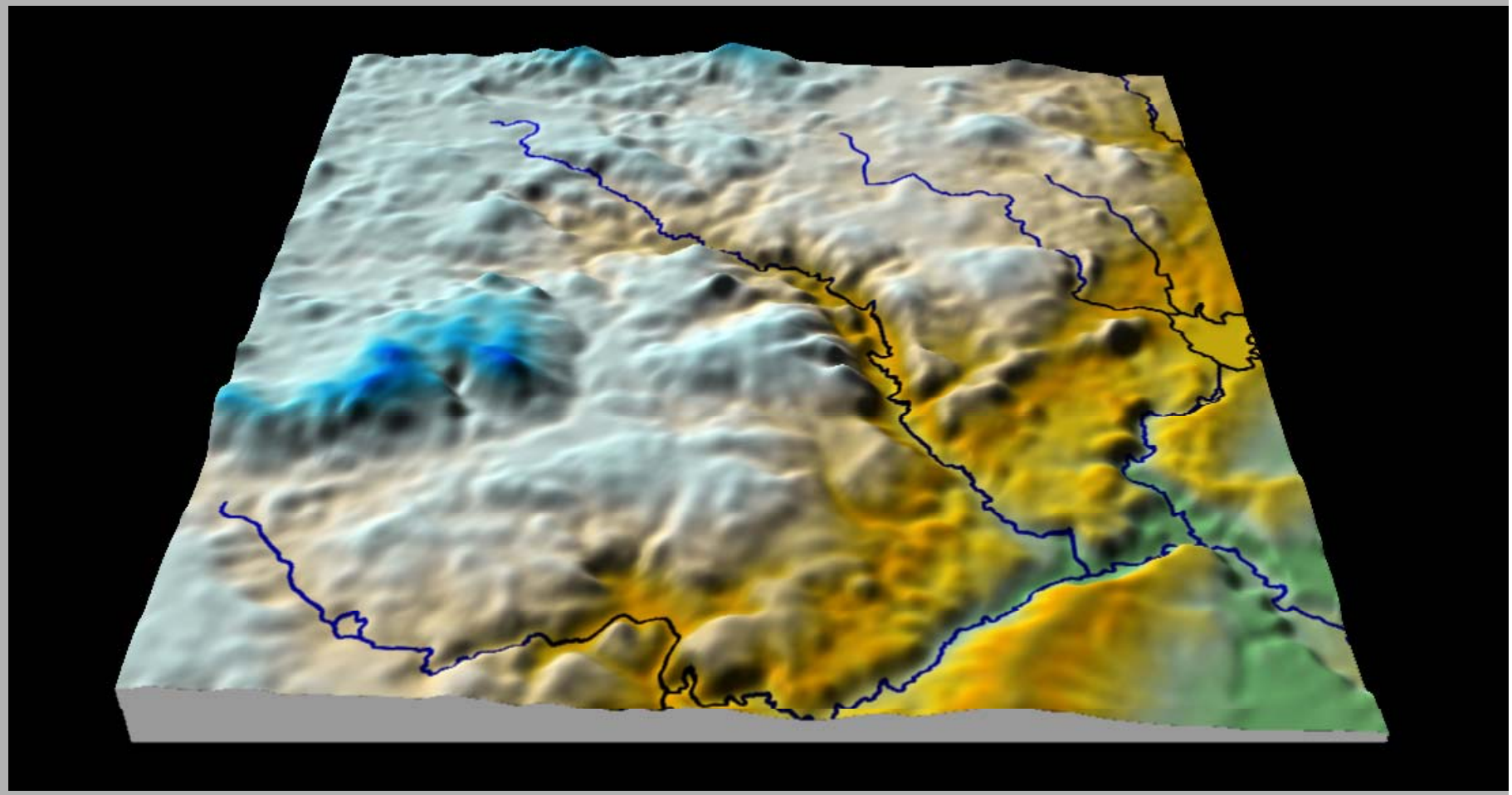
Clinton River

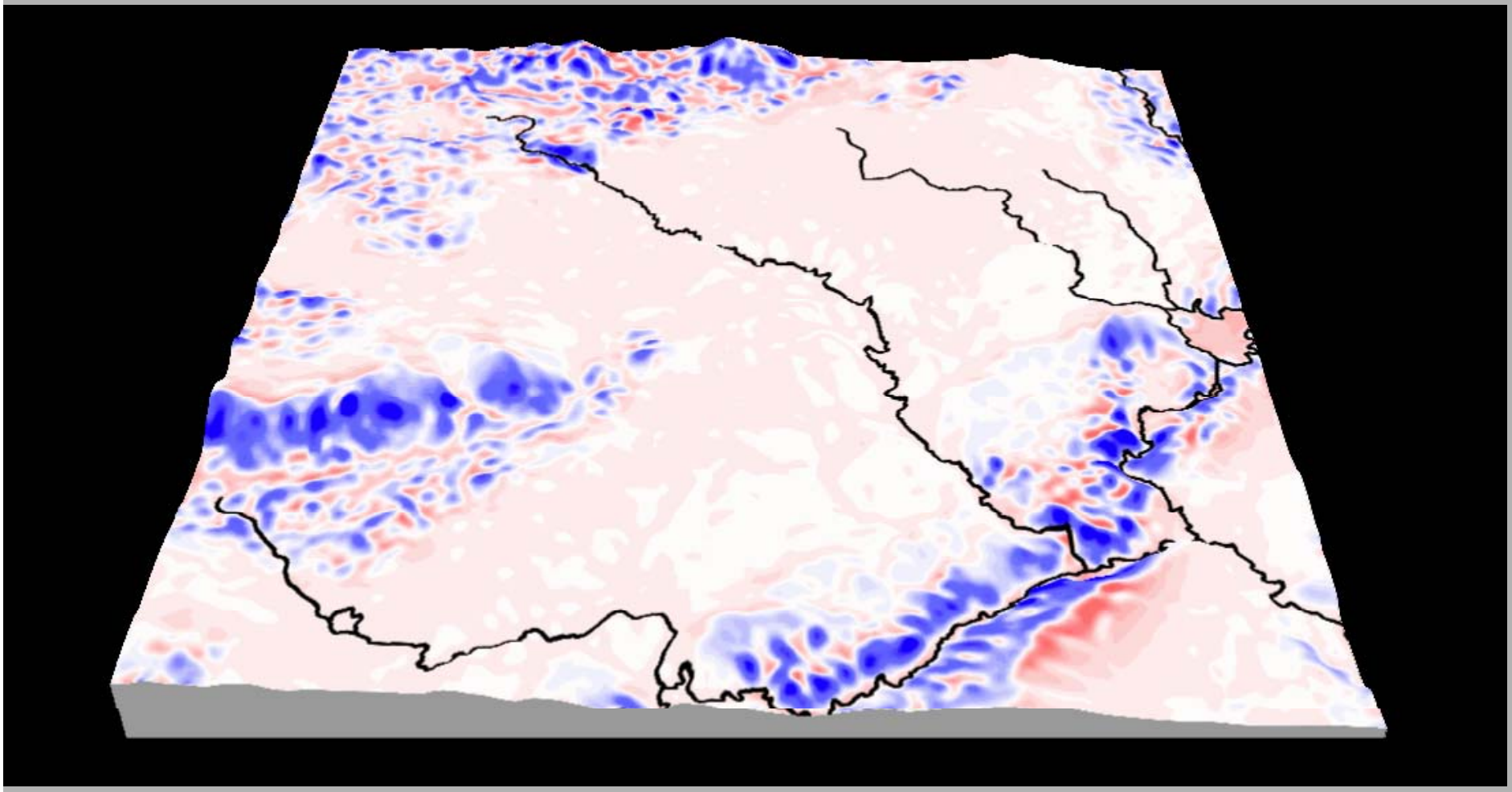




Darcy image (potential for groundwater movement) draped over surface relief map – Red area suggests discharge from ground to surface water and Blue denotes groundwater accumulation

Paint Creek





Darcy image (potential for groundwater movement) draped over surface relief map – Red area suggests discharge from ground to surface water and Blue denotes groundwater accumulation